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CHEMICAL & METALLURGICAL ENGINEERING

H. C. Parmelee
Editor

Volume 34 New York, July, 1927 Number 7

Rationalization, a New Factor in German Competition

THE cost-reduction idea has taken hold in German industry. They speak of it there as rationalization, and the interest displayed is reminiscent of the American vogue for scientific management twenty years ago. It was strongly advocated by the German delegates to the International Economic Conference at Geneva as a vital factor in the rehabilitation of business and industry in Europe; and with characteristic thoroughness and faith in their own ideas they are actively putting it into practice at home. Economic necessity is pressing them to adopt all possible measures to improve trade, and the government is supporting the movement.

IN ITS broad German conception, rationalization includes standardization and simplification, reduction of waste and scientific management, labor-saving equipment, reduction of overhead cost, economy in selling, and finally—and highly important from our point of view—the consolidation of corporations with allocation of production and the closing of uneconomic industrial units. The program as a whole has a familiar sound to American industry, but it is a new factor in Germany—a constructive policy of internal reorganization that has gripped not only industry but has enlisted the sympathy and co-operation of labor and the public.

FROM the point of view of American industry, particularly the chemical industry, the industrial consolidation feature of rationalization deserves special consideration. Industrial consolidations have multiplied rapidly in Germany in the past two years. The largest is the Interessengemeinschaft Farbenindustrie, commonly called the I.G., which has a capital of 1,100,000,000 marks and represents the consolidated chemical industry of Germany. The policy has resulted in specialization in production, operation of the most efficient units, strengthening of sales efforts and more economical distribution. Finally it has the sanction and encouragement of the government.

IN THE other phases of the movement Germany's penchant for research is coming into full play. Economic, scientific and engineering studies are being encouraged and financially assisted by a special government organization headed by Dr. Carl F. von Siemens. It serves as a clearing house for known information, initiates and temporarily supports new studies. In addition there is a national committee that encourages standardization in all its ramifications throughout industry. Nearly two thousand standards have already been approved, covering materials, equipment and methods. In fact this phase of rationalization has been carried into minute details that would seem to us of minor importance.

WHAT is the significance of this new German activity that is being approached with such enthusiasm? Obviously improved conditions at home, but likewise a fundamental effort to gain a strategic position in world competition. Cost-reduction through logical economies in material, labor, time and method is the accepted American approach to industrial prosperity. Our experience is an open book to the world; but the more our example is followed, the greater the challenge to our present position. Germany, for one, is offering that challenge, which means that American industry must not cease its efforts in scientific cost reduction.

Equipment Only Half the Story

AFTER an interim of two years the Exposition of Chemical Industries will be held in Grand Central Palace, New York, next September. Several factors conspire to emphasize the value of this eleventh exposition and intensify its interest for the American chemical industry. In the first place two years have elapsed since the last exposition, during which time progress has been made that should result in showing new developments in chemistry and chemical engineering. Second, the exposition will have a definite international character, with exhibitors from Germany and other foreign countries. Finally, the educational activities of the exposition will be better organized than ever before, with consequent advantage to exhibitors as well as those who come to study.

There is one feature of the exposition, however, that needs strengthening, and that is the participation of chemical manufacturing concerns. In the early history of the exposition chemical and equipment manufacturers both exhibited their wares. Later the chemical manufacturers dropped out gradually until, about six or seven years ago, they were almost wholly absent, and the visitor to the exposition was inclined to wonder whether there was an American chemical industry. Subsequently the number of exhibitors of chemicals has grown slightly but not commensurate with the total number of manufacturers or the importance of chemicals *per se* in American industry as a whole.

It is a false premise that the exposition is primarily an exhibition of chemical engineering equipment. Its name indicates its broad character. It is a "chemical" exposition and cannot be complete without exhibits of chemicals and chemical products. Surely there is something new under the industrial sun in that branch of industry. Staples there are, of course, but new products are being made that need a wider introduction and acquaintance. Even staples are finding new uses with changing industrial conditions. Specialties are being produced of which possible consumers are unaware. The exposition offers just as wide an opportunity to spread knowledge of new chemicals as of new chemical engineering equipment.

As a matter of fact, equipment is only half the story to the exposition visitor. Granted that he is concerned with equipment for his process. He is equally interested in the chemicals that enter into that process and is quite as eager to meet and talk with the chemical manufacturer as with the equipment maker. Furthermore, the chemical engineering industries that use most of the equipment are also the biggest buyers of chemicals. What more logical, then, than for both groups to exhibit to the largest possible extent at the same exposition?

It is not a question of the chemical manufacturer "supporting" the exposition, and *Chem. & Met.* makes no argument on that score. We "support" charities and social welfare movements, but not expositions, trade associations and other business instruments for gaining publicity and expanding trade. We participate in these latter activities because we are parts of an industry to the advancement of which they are dedicated. On this ground *Chem. & Met.* hopes that chemical manufacturers will decide to exhibit in large numbers at the chemical exposition next September.

What About "Chemical" Lime Investigations?

KEEN REGRET has been expressed by certain of the larger producers of chemical lime that the National Lime Association will no longer be able to continue its technical investigations because of the curtailed budget. Some of these producers point out, and all others soliciting business in the chemical field must know, that lime is a chemical reagent vital to many industries and one about which there is still an amazing lack of information. The fact that lime is one of the oldest known heavy chemicals does not offset the fact that it is one of the least understood chemical reagents for certain of its important applications.

This lack of information emphasizes the necessity for co-operative effort among chemical lime producers in the furthering of additional research. *Chem. & Met.* sees no reason why the producers who recognize this need should not continue to co-operate through the National Lime Association. If there are a few such companies who will back their interest with small appropriations it should not be difficult for the association to arrange a resumption of industrial research on a co-operative basis, either at the Bureau of Standards, at Massachusetts Institute of Technology, at Ohio State University, or any one of the other such places where co-operation has been so successfully carried out in the past.

Chem. & Met. believes that some such scheme can be developed to the mutual advantage of the individual contributors to the fund and of the research agencies participating. The fact that all of the industry will ultimately profit by the results of the study should not deter such contributors. It is unfortunate that all of the industry cannot well have a direct share in the expense; but those few most vitally concerned in this particular market need not allow this to prevent them from seeing that the necessary work goes on.

World Business Conferences Point Way to European Recovery

EARLY in July the leading business men of the world, meeting at Stockholm in the International Chamber of Commerce, took steps to put into effect the conclusions of the International Economic Conference held at Geneva in May. The Geneva conference for the first time gave the world a clear picture of Europe's economic ills and of the necessary remedies. The International Chamber approved the Geneva conclusions and called upon its national committees, organized in the several countries, to urge their respective governments to pass the necessary legislation to make the conclusions effective. The votes of the delegations were a virtual pledge that they would bring such pressure to bear on their governments.

The conclusions relate chiefly to the removal of trade barriers as an essential first step in the improvement of national conditions. Certainly nothing can so speedily contribute to the revival of Europe. Such a revival is imperative. Continental Europe has made good strides in recovery, but further progress is impeded by the trade barriers everywhere erected. Trade is lagging. Unem-

ployment is large and living standards are below those of pre-war times.

At first sight the task would seem impossible because of the selfish national ambitions involved, but all European business men realize that the trade barriers erected for national self protection have failed to bring prosperity. Counter barriers have been erected and the flow of goods has been checked with resulting impoverishment at home. This "collective insanity," as Sir Arthur Salter called it, is now recognized by all business men and by many statesmen. The business men must carry general conviction to the public and the governments.

There is good reason to hope for results aside from the selfish desire for better business. There is the larger impelling motive of improving conditions for the multitudes now suffering from a reduced standard of living. The need to relieve them is frequently expressed. With such motives and with such forces in motion there must be results.

Where Trouble Does Not Thrive

THE FOUNDER and head of a great industrial organization recently ascribed the remarkable success of his company to the fact that it was so conducted that trouble did not thrive within it. Since its beginnings as a small concern, many years ago, it has never known a strike or other labor disturbance. Many times the attempt has been made by outside influences to break up their splendid record. But these efforts came to nothing, for the employees of the company paid them no heed.

This remarkable result has been achieved through what our friend calls a policy of co-operation. The company believes that not only conditions on the job itself, but also home and community conditions, all share in determining the worker's satisfaction with his job. With this policy in mind it has taken the lead, not only in establishing the best possible working conditions, but also in making the community a pleasant and healthy place in which to live. This has not been done in a spirit of paternalism; but rather the company has been but the leader in a work carried out by the whole community, from the chief executive of the company down to the youngest or least important of the employees.

The result of this policy has been that the worker brings to the job not only his hands, but also his head and his heart. It is his company for which he works; and the whole happiness and content of his home and community life, as well as the success of his work, is bound up in the company's success. Where such a spirit exists, it is evident that the troublemaker can have no success and unrest makes but little headway.

There is a lesson in the policy and consequent success of this company that other organizations can well afford to take to heart. Dissatisfaction and unrest, even when they do not reach the point of labor troubles, work greatly to enhance production costs. Contrast to this the economies that must be made, when all the workers bring to their work not only willing hands, but loyalty and a brain alert to make improvements. We are confident that many others can profit from the experience of the plant "where trouble does not thrive."

Taking the Government Out of Business

ANNOUNCING the transfer of the transcontinental air mail service from the government to commercial operation by companies holding contracts with the Post Office Department, Postmaster General New stated:

> This action will bring to consummation original plans of the Department which were: First, to demonstrate the feasibility of through transcontinental service by air on schedules calling for regular arrivals and departures, regardless of ordinary adverse weather conditions and flying through the hours of darkness as well as daylight; and, second, to transfer to private initiative as soon as commercial aviation companies became strong enough, not only the physical assets of the governmental service but the technical knowledge and information built up through the years of experience in this new field.

In this announcement is included a sound definition of the conditions under which the government can effectively and legitimately go into business, namely for the development of a new type of enterprise for which commercial investment cannot be expected because of the large initial risk. In this statement is also a splendid definition of the time when the government should go out of such business—"As soon as commercial . . . companies become strong enough." All branches of industry will agree with Mr. New's statement as a general definition of governmental policy.

Removing Rust from Industrial Piping

INHIBITORS are intensely interesting materials. When a small quantity of one of these organic substances is added to an acid, the solution becomes almost entirely passive to metals, yet its rate of dissolving rust or scale remains practically unchanged. There is something dramatic in this control of chemical activity which is entirely lost in the prosaic operations of pickling iron and steel, in spite of the fact that Speller and Chappell show in an article in this issue that the inhibitor does a yeoman's service in saving acid and preserving the metal.

More spectacular, and therefore more engaging to the layman at least, is the application of the rust removing process to the piping system installed in a great office building. The thought of using hydrochloric acid for cleaning iron and steel plumbing is a disturbing sort of heresy that only modern science can dispel.

The rust removing process, as carried out in the 35-story office building of the Bankers Trust Company, was described to the Cleveland meeting of the American Institute of Chemical Engineers in a paper by Speller, Chappell and Russell. It is extremely simple, yet one that required capable supervision for its successful working. Many precautions must be taken; and a certain resourcefulness that comes through chemical engineering knowledge and experience is necessary in order to meet the emergencies that are bound to occur. But in such hands the process is one that promises to be of immediate public service and when further developed may prove equally applicable to industry for removing rust from condensers, boilers, heaters and other industrial equipment that can not be readily cleaned by ordinary methods.

Manufactured City Gas As An Industrial Fuel

By Graham L. Montgomery

Assistant Editor, Chem. & Met.

MANUFACTURED city gas is rapidly becoming an important industrial fuel. In two of the largest cities of the United States approximately one-quarter of all the gas made is so used, while in many other localities this use is growing toward that point. The industrial department of one of the large gas companies is authority for the statement that within a few years fully one-half of all the city gas made in their territory will be used for industrial purposes.

Successful applications of manufactured city gas as an industrial fuel in many varying industries indicate that no heat-using industry can afford to neglect investigating the possible applications of this fuel

With these facts in mind, it is important to seek the underlying reasons for using city gas as an industrial fuel. Of course, there has been much propaganda aimed at inducing industry to substitute manufactured gas for other fuels. But such propaganda could have little permanent effect unless there were good reasons for the substitution. And, particularly in the chemical engineering industries, this fuel is often still considered too expensive to compete with coal or oil as a source of heat.

Whether this is so or not depends upon two things; the price of manufactured gas in any given locality; and the industry in which the application is proposed.

Gas varies in price throughout the country, there being no standard price. Because of this, industries which can afford to use gas in certain places cannot do so in others. The price may be so high that gas cannot be considered at all, or the region may be one where competitive fuels such as bituminous coal or oil are relatively very cheap.

IN A general way, there are three types of industrial application in which the use of city gas as a fuel must be considered. These are:

1. Where a product of the desired quality can only be made by the use of gas or electricity as a source of heat.
2. Where gas is in competition with sources of heat other than electricity, but the factors of price, convenience in use and qualitiy of product may be in its favor.
3. Where the cost of heat in the finished product alone is the deciding factor.

These three cases are well illustrated by the three industries depicted in the accompanying photographs. Figs. 1 to 5 show applications of gas in the world's largest plant for the manufacture of bottle crowns, the Crown Cork & Seal Co., Baltimore, Md. This industry is only in part a chemical engineering industry, certain of the processes used being of a distinctly mechanical nature while others are among the unit processes of chemical engineering. Briefly the work consists of manufacturing cork disks, of preparing tin plate with coatings of lacquer or enamel and printed or lithographed patterns, and finally of assembling the cork disk in the tin plate crown to form the finished product.

Formerly the cork disks were cut direct from sheets of cork and required no special processing. At present the available supply of cork does not allow this to be done to any great extent with economy. Hence the disks are made from ground cork by a special process and are called "Serax" composition disks.

In making these composition disks the cork is first ground, in several steps with intermediate drying to eliminate moisture and prevent expansion and contraction in the finished product. It is next graded as to size and all undesirable material rejected. The resulting finely divided cork is next thoroughly mixed with a previously prepared binding material. The resulting mixture is stored under conditions of controlled humidity and temperature until seasoned and required for further processing.

IN MANUFACTURING the disks from this ground cork is an application of gas heat where no other form of heat, perhaps, would serve as well. Fig. 1 shows the machine in which the cork is baked into short "sticks" or rods from which the disks are sliced. On the platform is an automatic feeding device, supplied with cork and binder mixture from an overhead hopper, which fills each of the molds of an endless moving chain as these pass by. The molds then pass through the heating section, the square-covered section in the middle of the picture, where they are subjected to a direct gas flame for just sufficient time to melt the binder. The gas fuel permits an accurate and sensitive control to be maintained on this heat.

On the remainder of the run of the endless chain the molds are cooled sufficiently to harden the "sticks," which are then automatically ejected and the molds refilled. The "stick" is then sliced into disks, the disks cleaned, sterilized and finally treated with paraffin. After final inspection, the disks are then ready to incorporate in the finished crowns, the metal parts having been made elsewhere in the plant.

There are several steps in the preparation of these

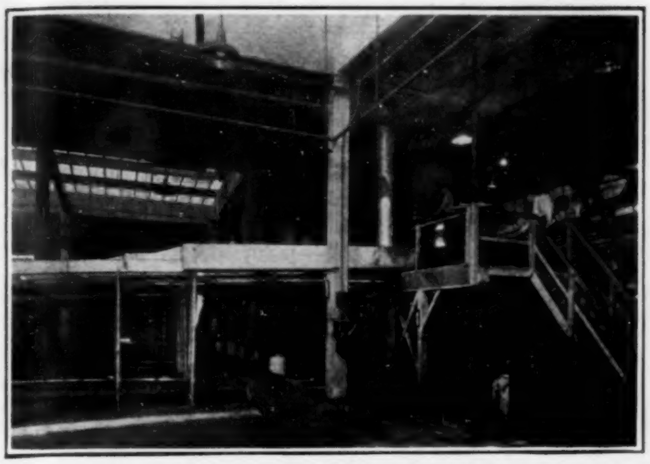

Fig. 1—Heating Section of Machines For Making Cork "Sticks"
These machines consist of endless chains of molds. The molds are first filled with the "Serax" ground cork composition. They then pass through the heating section here shown, after which they are cooled and the cork "sticks" discharged, to be later sliced into disks

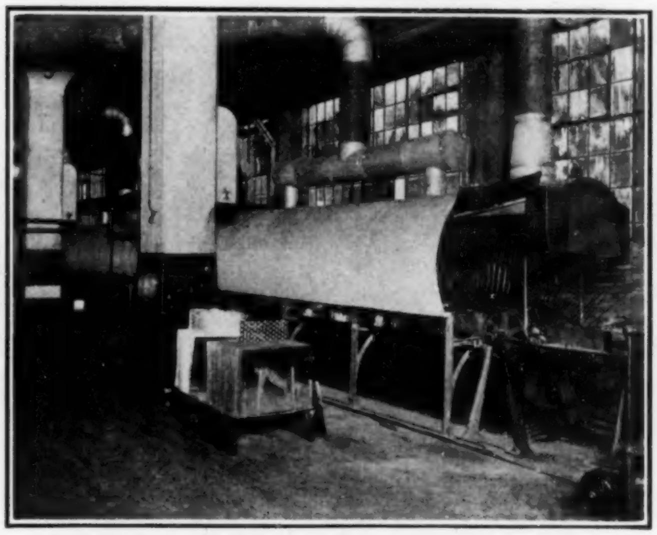

Fig. 3—Gas-fired Lithographing Oven
In this special, continuous oven the tinned sheets from which bottle crowns are made are baked after ltihographing

composition disks beside that mentioned where gas heat is used; but that is primarily because it is available and convenient, not because some other form of heat would not do the work.

In the preparation of the tin-plate from which the metal crowns are to be punched, the sheets are covered with lacquer or other adhesive coating on one side, the desired design is then printed on the other side in special presses and finally a protective coating is put on over the decoration. Each of the several coats must be baked on. This is done in specially designed gas-heated ovens with electrical control as shown in Fig. 2, 3, and 4. Gas heat is the most suitable heat for this purpose, maintaining the correct atmosphere in the ovens and being susceptible to extremely close control as to temperature limits.

In the machines which assemble the metal crown and the cork disk, shown in Fig. 5, it is necessary to apply heat to the assembled crown. This heat serves to stick the disk tight in the metal crown. Due to the nature of the machine in which this assembly is accomplished, the heat must be absolutely steady without necessity for control. This can only be accomplished by the use of gas, which is premixed with the necessary air for combustion by means of the Kemp system and fed in predetermined quantity to each burner.

The second type of application, where gas is in competition with other sources of heat, but the combination of cost, convenience and quality count for it sufficiently to make it preferred, is illustrated by the plant shown in Figs. 6 to 8. This is the Baltimore plant of the Porcelain Enamel & Mfg. Co., manufacturers of a complete line of porcelain enamel, both regular and acid resisting for sale to the enameling trade. An enameling plant on a small scale is maintained on a productive basis so that the company can try its new developments under factory conditions.

Enamels, though they are a form of glass, are now largely made in a type of furnace widely differing from glass furnaces. Formerly all enamels were made in furnaces closely resembling glass tanks and many such furnaces are in use today. The more recent practice is, however, to use furnaces of the rotary type shown in Fig. 6. These furnaces are somewhat like a miniature cement kiln. The raw material is placed in the refractory-lined cylinder into which a burner is inserted at one end, the other being connected to the stack. As can be

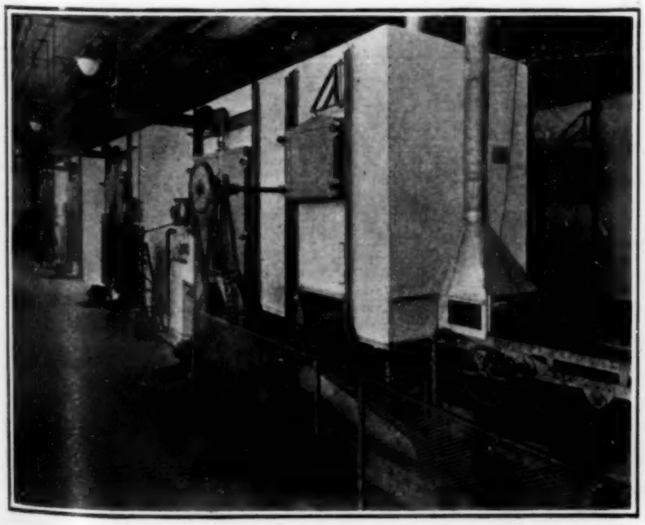

Fig. 2—Gas fired Lacquering Ovens
Here the tinned sheets from which bottle crowns are stamped are baked to "fix" a coat of lacquer with which they are previously covered

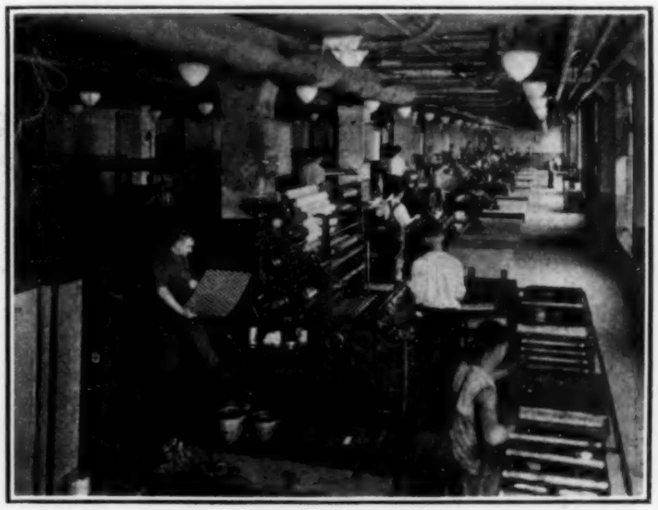

Fig. 4—Battery of Lithographing Presses and Ovens
These ovens, of gas-fired type, are similar to those shown in Fig. 2, but are shorter. They differ somewhat from the oven in Fig. 3

Fig. 5—Battery of Crown Assembling Machines
Here the finished metal crown and the cork disk are assembled. Gas heat is used in attaching the cork to the metal

seen from the photograph, the burners are so mounted that they can be moved away from the burner hole for inspection or adjustment. When placed in position at the burner hole, the opening is closed.

The raw materials are heated in this furnace for a sufficient period at 2,100 to 2,200 deg. F. to completely fuse them into a glass. At the end of this period, the molten charge is emptied into a bath of water, where it solidifies into small brittle globules. These globules are then wet-ground in pebble mills to form a thin paste which, when sprayed on the article to be enameled and then fired, forms the enamel coat. When sold for use by other plants, the globules, called "frit," are shipped before grinding.

The heating of an enamel smelting furnace can be conveniently done by any fluid fuel. Gas is, however, the preferred application, because of convenience in use and the ease with which it permits the production of a high-grade product. When oil is used for heating these furnaces, it demands the closest possible regulation, for any incomplete combustion results in the production of carbon which spoils the product. With gas however, the burners, of the inspirator type, can simply be set to give the correct amount of heat and no further attention is necessary. The foreman of the department can make any adjustments of setting, when charges are changed, in a few minutes.

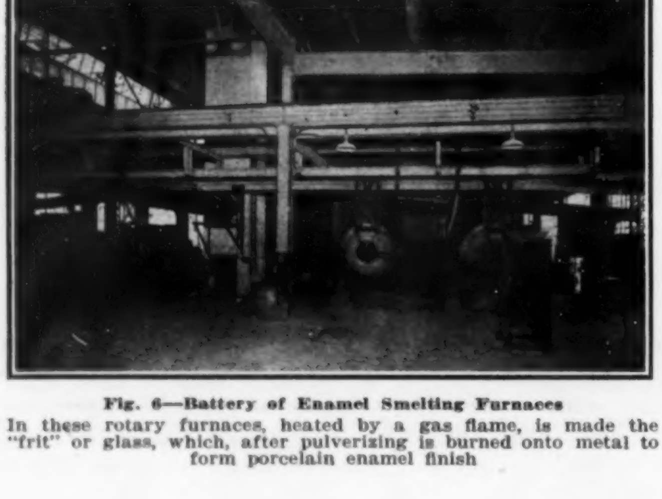

Fig. 6—Battery of Enamel Smelting Furnaces
In these rotary furnaces, heated by a gas flame, is made the "frit" or glass, which, after pulverizing is burned onto metal to form porcelain enamel finish

Fig. 7—Gas-fired Enameling Furnaces
In these furnaces metal parts, first coated with a paste of pulverized "frit", are heated. This results in burning on a porcelain coating

In burning the enamel coating onto metal parts a muffle furnace of the type shown in Fig. 7 is generally used. This type of furnace may be heated by any means available, but gas is used in this plant and many others and has proved highly satisfactory for the purpose. The ware is fired at temperatures ranging from 1,600 deg. F. down to 1,200 deg. F., depending on the enamel and the metal base being used Automatic control is used on the gas burners of this furnace, the temperature being shown by both indicating and recording pyrometers.

The advantages of using gas in place of other fuels for heating these muffle furnaces are less wear on muffle and increased production. This latter advantage is due to quicker heating and less down-time for the furnace, while the first advantage is due to the characteristics of the gas application.

Aside from these two important applications of gas heat, this plant uses gas for every other heating operation throughout its work. Even the factory and office buildings are heated by gas, a gas-fired steam boiler supplying steam heat for the offices and gas-fired air heaters being used in the factory. The steel sheets, before enameling, are cleaned by pickling. The pickling bath is heated by means of a submerged coil, through which the hot products of combustion from a gas burner are led. After pickling and rinsing, the sheets are dried

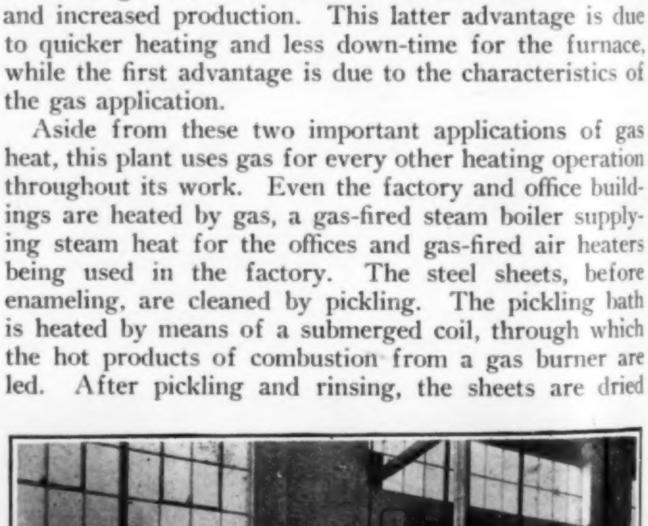

Fig. 8—Low-heat Gas-fires Oven
This oven is used for burning onto porcelain enameled ware designs transfered to it by the decalcomania process

Fig. 9—Enameling Furnace for Rough Cast Iron Ware
In this type of furnace, formerly fired by coal, gas has proved to have such a high utilization factor as to make the process more economical

in a compartment drier heated by gas. Another use of gas is in heating the gas-fired oven shown in Fig. 8. This is a low heat oven in which decalcomania decorations, names, numbers or patterns are burned onto the enameled ware. It operates at a temperature varying from 400 to 500 deg. F.

AN EXAMPLE of the third case is the Jones Hollow Ware Co., of Baltimore. This concerns enamels cast-iron sanitary ware and similar products. Gas is used for heating a reverberatory furnace in which the frit is smelted. This furnace was originally fired by coal. With gas heat it has been reduced in size one-third and still gives the same production. This is not of much importance, however, as the furnace is only used part time and there is plenty of space for it. The chief saving has come from the reduced amount of labor required and the fact that it can be heated up in five hours after a shutdown in place of the ten hours necessary before the change. This saving in time simplifies the whole plant operation.

The enameling furnace in this plant has also been changed to gas heat and a remarkable advantage has been achieved thereby. This furnace, shown in Fig. 9, is not of the muffle type, the firing being done under a perforated hearth and the products of combustion passing up around the ware to a flue at the top. Application of gas heat has reduced the size of this furnace by one-third and has increased the output 40 per cent without increased labor costs. This increase in production more than compensates for the increased fuel cost of gas over coal. It also enables the operators to earn a better wage while, at the same time, the company realizes increased profits from their plant.

IN RECOUNTING these examples of the use of city gas for industrial heating purposes no details concerning gas handling or burner applications have been given. Such details will vary to suit each individual case and applications should only be made after thorough studies by one of the trained experts now employed by all large gas companies. The examples given serve to show that gas heat can be used with economy by a wide range of industries and suggest that it may prove worthwhile for industries using heat to find out whether gas heat holds any advantages for them.

Italy's Economic Situation and Organization

By Edward J. Mehren

Vice-President, McGraw-Hill Publishing Co., Inc.

So much has been written lately about Italy and Italian conditions that one is in danger of repeating what is already well known in the United States. But in this article the emphasis will be laid on the economic and industrial situations: the political and social naturally get most attention. Even in an economic discussion the political and social conditions cannot be excluded. The social situation, in particular, forces itself on the attention of the visitor. It is the outward spirit of the new Italy; it permeates the atmosphere and colors every contact that one has on the streets, in offices, in railway trains.

BEFORE proceeding to the economic situation let one instance of the new spirit of Italy be given. Coming by motor over the Simplon Pass we picked up two punctures near the border. Changing one tire, we limped into Domo d'Ossola by pumping the other at intermediate points. Our first need, therefore, was a garage, so we stopped at a corner café (the respectable European brother of the former American saloon) to make inquiry. After getting directions and arranging to send the car to the garage I reached for my overcoat lying on top of the luggage. Immediately our informant remarked that in Italy I need not worry; the coat would be safe; and this man had an understanding of my mind for he had spent six years in America. What he said was brief, but it was said with pride and confidence.

This note, struck at our very entrance to Italy, has recurred again and again. Socially, Italy is a new land. Its people are conscious of the change and show their pride. Underneath there may be—there undoubtedly is—grave reservation as to the need or wisdom of the methods that have been employed; but, for the obtaining of results, "the plan works," and to the hurried traveler all looks placid.

AS TO economic conditions, is is clearly evident that prosperity reigns; having seen Western Europe, including Germany, in the low ebb of 1920 the difference is apparent. The people on the whole are well dressed and have a confident bearing. The latter point is important; judged by the economic experience of other countries, Italy should now be under severe economic distress. A year and a half ago the lira stood at 30 to the dollar. Now it is 18½. It has gone from, say 3⅓c. to 5½c. The usual accompaniment of such a rise is the falling off in buying power and a decline in exports, resulting in a decrease in demand on industry, unemployment and the usual accompanying distress.

These phenomena are not absent here now, but, as

yet, there is not a crisis. There has been export decline, but it is slight. There is unemployment, but not serious, though a goodly number of factories are on a part-time basis. Possibly the best general index is that of electric-power sales. While the annual increase in sales since the beginning of prosperity under the Mussolini régime has been at the rate of 10 per cent, the increase in the first four months of this year over the corresponding period of last year has been about 3½ per cent. The rise in the lira, then, has slowed down development but not precipitated a crisis.

This improvement in the value of the lira was a cause for congratulation on the part of Mussolini in opening the Parliament on May 26. It was said two years ago that Fascism had lost the economic battle —the "battle of the lira"—even though it might have triumphed in other fields. For that reason the Prime Minister had directed the minister of finance, Volpi, to take all needed steps to improve the financial position.

Naturally, the big question is as to the future of the lira. Some feel that it has improved too rapidly; they would, in fact, like to see it slip back so that export and tourist trade would be encouraged. Evidently Mussolini is fully aware of the situation. Using military phraseology, he said that they had captured Hill 90 (90 lire to the pound sterling) and would rest there to reconnoiter their position. In other words, the future campaign will be determined by the results of this one; and the results are not yet fully apparent.

What the future holds economically even with the lira held at its present position is not clear. Some predict a more serious situation, maintaining that the full effect of the increased valuation is only now beginning to be felt; until now goods have been shipped on contracts made before the rise. New orders, on the new value of the lira, are not coming in in so large a volume. On the other hand, there are men of affairs who believe that the present political régime will adopt measures—and successfully enforce them—that will prevent serious distress.

THE CRUX of any situation like this is that prices are not reduced in proportion to the increase in value of the exchange medium. The fascist régime is now tackling this point. As of June 1, the salaries and wages of all in the national government service will be reduced 10 per cent; this includes the wages of post office and railway employees. Through the Union of Confederations of industry, the industries will be requested to make a similar reduction.

But wage reductions alone would virtually increase the cost of living, by reducing the purchasing power of the worker. Therefore, there have been decreed compulsory decreases in rent and in food necessities. Rent, now from five to seven times pre-war prices, must be reduced to four times the pre-war basis. Milk, bread, rice, marcaroni (and its various brothers) and meat have been reduced 10 per cent. The enforcement is very severe, and precautions are taken that the law is not evaded by decreasing quality. Going still further, the communes are co-operating and have requested all merchants to make general reductions in prices. The shop windows in the cities and towns are almost all displaying reduction signs; and the reductions range, so the signs say, up to 30 per cent. The hotels have put into effect a 10 per cent reduction and hope, they say, to make further reductions. Here necessity has been an added spur; the tourist travel had fallen off. Obviously, the 10 per cent decrease is out of all proportion to the increase in the value of the lira; even the sharp recent increase has been 40 per cent. A beginning, however, has been made, and those who believe that a sharp crisis will be avoided look forward to repetition of the recent price and wage reductions.

Incidentally, these wage reductions may well be a test of the strength of the Mussolini régime. It is easier to hold the multitude on a rising market than to lead them backward. True, price reductions may hold the purchasing power even, but cash in hand means more to the un-lettered than purchasing power. Nevertheless, the fulsome advertising in the press, by commune proclamations, by displays in shop windows, by general conversation constitutes a mass campaign of education that may impress everyone. One card is up the Premier's sleeve. With the control he has he could let the lira slip back again, and start a buying boom. So, all in all, the situation would seem to be in hand, even though the stage is set for economic stress just now.

BUT no matter what the immediate situation, Italy has a difficult economic position. To state it is but to recall what every informed American knows. She lacks natural resources, her soil cannot now support her people, she lacks the capital resources to industrialize rapidly enough to give employment to a rapidly increasing population. Before the war her surplus population emigrated, principally to the United States; she has not yet created the mental conditions to avail herself of other outlets—South America, and possibly Canada. She came out of the war with a high per-capita debt charge that necessarily will go on for more than a generation. Yet she has a population of marked intelligence, capable, if there were opportunity, of playing a great industrial rôle. She must industrialize—that is the law of the present-day world; but on that industrialization are placed the handicaps previously referred to. Just now, her trade balance is adverse yet she has large payments to make on war debts. Nevertheless, she is borrowing abroad money that will require a still greater excess of exports in order to pay the interest and, when the time comes, the principal. American bankers alone have loaned Italy, the government, Rome, Milan and industries about $277,000,000 in less than two years.

The task involved is no small one. Italy's "way out" is to cut down her standard of living—she is on "war bread" again, for example—to reclaim her swamp and arid lands and to develop her hydro-electric power. Thus she will cut down her imports of foodstuffs and coal. To increase her exports, she plans further industrialization, and is building a great merchant marine which will build up her "invisible exports." Though the task is large, the outlook is not impossible judged by Italy's pre-war financial position. She then had an unfavorable trade balance of 1.2 billion lire, but this was balanced by tourist expenditures in Italy, remittances from Italians resident abroad and receipts from shipping. In addition, between the years 1890 and 1913 she bought back 6 billion lire of Italian government bonds held abroad.

Therefore, despite her financial obligations to foreign countries, accomplishment of a balance is not impossible. Moreover, the Italian, with his new-born con-

fidence, feels sure of the future, even though he realizes and admits that the task is big.

In a famous address in the Scala Theatre, in Milan, some years ago Mussolini thus epitomized his theory of government, "All within the State, nothing against the State, nothing outside the State." If the doctrine were to become more than abstract theory, industry was bound sooner or later to receive the Duce's attention. Its turn came last year. The result has been the federation of all producers—and not merely industry—into three great "unions," one for the employers, one for the employees, and one for the professional classes. The merchants and the bankers necessary to the productive function are also included. The entire organization heads up in the cabinet, in a "ministry of corporations," and at present Mussolini holds that portfolio among his many others. Thus there heads up in him the whole productive and distributive mechanism of the kingdom—the industrial and agricultural employers, the merchants and the banks; the employees, industrial, agricultural and commercial: lastly, the professional classes.

UNDER the ministry of corporations come the three great unions of confederations. The union of confederations of employers and the similar union of employees have each six constituent confederations: for industry, agriculture, commerce, maritime and aërial transportation, land and internal waterway transport, and banking. Each of these confederations, in turn is made of national syndicates of important industries, resembling our industrial and trade associations. For example, the Confederation of Industry has six constituent syndicates, namely, for chemicals, silk, cotton, the mechanical industries, the metallurgical industries, and miscellaneous industries. The land and internal waterways confederation is divided into four groups: railroads, motor transport, internal navigation, miscellaneous agencies.

Up to the present the organization of professional people has not been completed, but it is to have three confederations—of professional men, of artists and of artisans. Under the professional confederation are to be syndicates of chemists, of engineers, of agricultural specialists and of a miscellaneous group.

IN ORDER that all interested in one line of industry, trade or agriculture may come together there is also a cross liaison, through a group of "corporations," in which employer, employee and technical group syndicates may get together.

In all these unions, confederations and syndicates, the directing officials are appointed by the ministry, but selected from the group in question. In each provincial town, where the numbers warrant, there is also a secretary for each syndicate, and he appoints a committee that has charge of the activities of the syndicate branch in the province.

Among the engineers, for example, the *Associazione Nazionale Ingegneri,* the former Italian national engineering society, has become by law the *Sindacato Nazionale Ingegneri,* and its officers are no longer elected by the members, but appointed by the ministry of corporations. Quite naturally the men prominent in such organizations before, are prominent in the local branches now, Rome relying upon local advice largely for the selection of local secretaries and the make-up of the managing committees.

One of the provisions of the law governing these organizations is that there may be neither strikes nor lockouts. Mediation must be tried first; if that fails, the controversy goes to an arbitral body whose decree is final and binding. Neither after the decision nor during the proceedings may there be a cessation of work due to the efforts of either party.

IT IS plain, therefore, that all productive forces of the country are under close control, and that an industrial, agricultural, commercial or banking policy, decided upon in Rome can quickly be put into effect. This explains the present unanimity in the reduction of industrial wages. There is no law, but the word having gone out from Rome through the union of confederations of employers, the results are even swifter than could be accomplished by legislation, for the organization is active right down to the factory door and to the meeting room of the labor union.

Under wise counsel on top it can be seen that such an organization is effective for just the sort of remaking that, by common consent here, Italy needed.

Aside from the administrative functions which naturally fall to the confederations and syndicates, Mussolini plans for his organization of producers a parliamentary function. He has announced that the present lower house of parliament selected on a territorial basis is to be discontinued and that in its stead will be a house made up of delegates from these confederations. The present session is to be the last of the old type of parliament. Presumably, the delegates to the new house will be appointed by the ministry, and not elected by the members of these bodies. The senate will remain as now. Of course, with the tight control on top this new house can be no more than advisory in character, or "approvative" one might say, but the scheme in theory is a recognition of the importance of the functional as against the territorial interests of the State.

ONE cannot but form some idea as to the wisdom of the régime as a whole. One cannot expect people that one meets for only an hour to enter into a full and frank discussion of the subject. The Fascists themselves make no secret of the quick way in which they deal with opposition; "nothing against the state" is the doctrine. What one sees and hears, then, are the surface things. Outwardly everything looks well. The country is prosperous; the people look and dress well, and appear confident. There is no doubt that the method works, and when one expresses doubt as to its wisdom the answer comes quickly that no other régime would have been adequate for Italy's needs at the time; and this statement is made with evident conviction by men of affairs. It is, of course, recognized here that Mussolini's method and his governmental theory run counter to the convictions of the Western world, but always there is the statement that Italy needed a strong control.

Has Mussolini hit on something that will be adopted into industrialized countries in the future? Obviously, his experiment would be more significant if the new house of parliament were freely selected and had liberty of action. Nevertheless, there is here an idea of importance—a deliberate adoption into government of functional representation, and a more thorough one than the German experiment. Despite its limitations it is worth watching.

Practical Recovery of Chemicals from Black Liquor in Sulphate Mills

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MANUFACTURE of chemical pulp from chipped wood depends upon dissolving out the lignin, or binding element, that consolidates the hair-like cellulose fibers in natural wood. Washed free from the chemicals and dissolved matter these fibers are the basis of ordinary paper. In the sulphite process wood containing little or no resin is usually "cooked" with a solution containing acid sulphite of lime under pressure. Resinous wood resists this solvent and is customarily pulped by cooking with solutions of caustic soda or sulphide of soda (the soda and sulphate processes), which produce kraft and kraft-like papers.

Sulphur and lime used in the sulphite process are relatively cheap, the pulp obtained by this method is high priced, and the chemicals have not previously been recoverable in a condition for return to the pulping process. Until recently they have been discharged into streams and wasted, excepting for a negligible quantity from which certain byproducts have been made for limited markets as binding material for road surfacing, foundry cores, and briquets and as supplementary filler in tanning hides. Attention has been devoted in the past few years to concentrating these sulphite waste liquors and burning them under steam boilers, but as yet with little practical success. The large quantity and comparatively high cost of the chemicals employed in the soda and sulphate processes, however, and the ease with which they may be salvaged in usable form have made it necessary and feasible to recover the chemicals and return them to manufacture at the pulp mills.

In the soda process the chemical is reclaimed by evaporation of the black-liquor to high density and the carbonization of this concentrate in rotary furnaces with the aid of sawdust and other wood refuse. Lixiviation with water, causticizing with lime and finally filtration yield a reconditioned material suitable for reuse in the digesters. The hot gases from the rotary incinerators are usually sent through a steam boiler and the heat is thus utilized.

Reclamation of the chemical from the black liquor of the miscalled sulphate process presents a more complex problem because the reclaimed soda must be salvaged in so far as possible as the sulphide. The make-up chemical is added as sulphate of soda (salt-cake) during combustion and close regulation of temperature and air admission is necessary for reduction of the salt-cake and for avoidance of reoxidation of the sulphide formed.

Soda process black-liquor is carbonized at a red heat in order to destroy all organic matter before lixiviation of the black-ash, and combustion of a large part of the carbon in the rotary is a benefit rather than detrimental. On the other hand the black-liquor from the sulphate process is charred to a much less degree in the rotary and red heat avoided as inducing the reoxidation of sulphide. After this partial carbonization the sulphate black-ash is usually discharged from the rotary on a fire-proof floor, close to one or more small, rectangular, continuously operated smelters (furnaces with refractory lining) to which air is supplied by tuyères. Calculated quantities of salt-cake are thrown upon the black-ash at short intervals and the mixture shovelled or otherwise introduced into the smelters. Here combustion takes place at temperatures high enough to fuse the residue of soda salts, principally sulphide and carbonate, which flows in a continuous stream into a stirred tank, filled with water, dissolving there until a predetermined density is reached when the tank contents are pumped out and another batch started. To insure sufficient carbonaceous matter for the reduction, more or less sawdust is usually fed into the smelters.

Gases evolved in the rotary apparatus during the operation just described are incompletely burned and are not hot enough to make them profitable for use under waste heat boilers. They are generally wasted into the atmosphere and their nauseous stench has caused exclusion of kraft pulp mills from many communities. Hot gases from the smelters are too small in volume to be used economically for steam generation and most often they are utilized by passing them over a disk-evaporator, where some of the heat is usefully absorbed in completing the concentration of the black-liquor from the vacuum evaporator before it is sent to the rotary incinerators.

THE urgent need for a simplified reclamation process that can utilize a maximum of the heat generated, destroy offensive odors and reduce power cost and labor turnover has led to many experiments in the direction of atomizing the liquor concentrates into a furnace unit and burning them in the same way that crude oil is burned. As long ago as 1873 an apparatus for such a purpose was described in a German publication on the pulp and paper industry. Numerous other attempts to burn sprayed waste liquors have since been made, many patents have been issued covering different forms of

furnaces, and from time to time sundry units have been built and operated with partial success; but in each of these instances an accessory fuel, usually a petroleum product, has been required for the maintenance of requisite temperatures for charring and ignition of the liquid spray.

Recently a commercially sound solution of the problem seems to have been reached through an assembly of a stationary furnace, steam-boiler, gas-scrubber and certain minor accessories. This process conforms with the chemical and mechanical requirements involved and makes available practically all the heat produced by the combustion without recourse to other fuel than that furnished by the organic solids of the black-liquor itself, at the same time eliminating entrainment of chemicals and abolishing the noxious odors associated with sulphate process mills. The installation is patented by C. L. Wagner and sponsored by the J. O. Ross Engineering Corporation, of New York. Two of these units are now being operated successfully, one on soda-mill and one on sulphate-mill black-liquors. These have demonstrated on a factory scale that the heat liberated in the combustion of the liquors is in excess of the thermal requirement for evaporating in multiple-effect, from 9 deg. to 36 deg. Bé., the material to supply 500 gallons of concentrate per hour to the furnace, plus a large overage of steam for other purposes. This has been accomplished without other fuel of any sort and with approximately one pound of salt-cake added to the concentrate as make-up, per gallon, and reduced to sulphide.

The unit was designed for a kraft-pulp mill at Muskegon, Michigan, and began operating in May, 1926, on sulphate black-liquor. Substantially the same type of furnace is used for sulphite and for soda waste-liquors, with facilities for removal of infusible gypsum residue and omission of a gas-scrubber in the sulphite furnace, and for both sulphite and soda liquors requiring no provision for reduction of sulphates or prevention of oxidation. However, only the more complicated sulphate unit at Muskegon will be discussed in the present article.

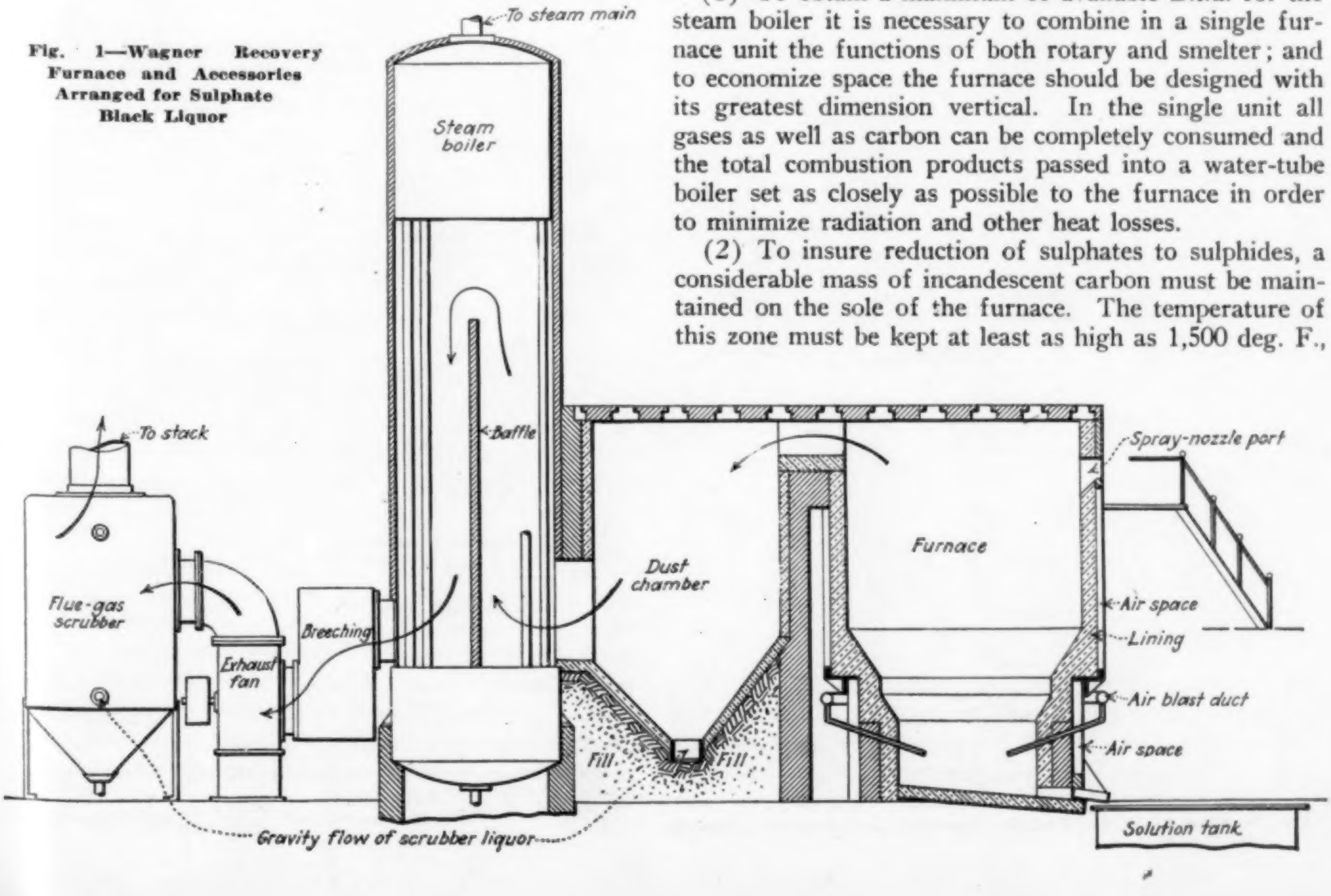
THE WAGNER reclamation unit at Muskegon comprises a circular, stationary, vertical combustion furnace with capacity of 500 gallons of black-liquor concentrate per hour. It is provided with means for preheating the furnace to the ignition temperature of the liquor, a plurality of spray nozzles for ejection of the concentrate into the furnace and means of controlling the supply of heated air injected at suitable points through the furnace wall under pressure. There is a dust-chamber between the furnace and steam-boiler, with a current of liquid—that may be scrubber liquor—circulated through it to carry off chemical deposits. A 500-hp. vertical water-tube boiler closely follows the dust-chamber; a powerful fan for induced draft is next to the boiler exit; and a mechanically actuated gas-scrubber is provided to entrap chemical particles that escape the dust-chamber and the boiler spaces. There is also accessory equipment to furnish compressed air for spraying and to supply lower pressure air for combustion; arrangements for insuring homogeneous composition and easy flow of the liquor; a removable oil-burning nozzle for preheating the furnace when making a cold start; and, finally a provision which although not essential is desirable with some woods, namely a means for firing with sawdust or wood-wastes to promote reduction of salt-cake.

Construction and operation of this furnace have been co-ordinated with numerous chemical engineering requirements among which the following are outstanding and have been given due weight:

(1) To obtain a maximum of available B.t.u. for the steam boiler it is necessary to combine in a single furnace unit the functions of both rotary and smelter; and to economize space the furnace should be designed with its greatest dimension vertical. In the single unit all gases as well as carbon can be completely consumed and the total combustion products passed into a water-tube boiler set as closely as possible to the furnace in order to minimize radiation and other heat losses.

(2) To insure reduction of sulphates to sulphides, a considerable mass of incandescent carbon must be maintained on the sole of the furnace. The temperature of this zone must be kept at least as high as 1,500 deg. F.,

Fig. 1—Wagner Recovery Furnace and Accessories Arranged for Sulphate Black Liquor



but not unduly hot, as there is likely to be excessive sublimation of soda salts which will re-oxidize in the upper part of the furnace, where air admission is always in excess of the needs for gas combustion.

(3) The quantity, pressure and distribution of air differ in the black-ash and the gas-combustion zones. A reducing atmosphere is necessary immediately over the former and the reverse in the latter belts.

(4) While carbon monoxide serves at the bottom zone as a protection against oxidation, reduction of sulphate and sulphite is chiefly effected by the trickling of the fused chemical over and through the carbon bed. To guard against entry of air through the exit port for the salt, which is always open, the draft is so controlled that a small flame of carbon monoxide blows from the opening; this also keeps the channel hot enough to prevent clogging of the bore with chilled melt.

(5) Practically all moisture and volatile matter must be driven off before the sprayed liquor reaches the bottom of the furnace; hence, fineness of the spray and the distance it is to travel must be closely regulated. Carbonization must be virtually completed before the black-ash bed is reached.

(6) A steady rate of combustion at all zones of the furnace is desirable and this is most nearly attained when the furnace section is circular. This construction also prolongs the life of the lining, as expansion and contraction cause much less strain and dislodgement of the blocks if there are no angles.

(7) Uniform density and even flow of liquor at the nozzles are not difficult to secure and help materially toward steady and effective operation. Density should be as high as is consistent with handling the liquor through pipe lines and valves.

(8) For preliminary heating of the furnace and for tiding over temporary halts in the supply of black-liquor, an oil-burning nozzle has been found indispensable. It is so located that it can be rapidly set in position, or withdrawn, and so that the flame will reach the actual sole of the furnace. Openings for sawdust or wood should be provided as such fuel has certain advantages in raising the temperature of the bottom blocks of the furnace from a cold start.

(9) Interposition of an ample dust-chamber between furnace and steam boiler not only helps in the complete combustion of the gases, but also acts as a trap for much of the sublimed material. Its function is also important in protecting the furnace walls from radiation to the boiler tubes. When these walls are directly exposed to the tubes, heat loss is so rapid that charring of the liquor spray is incomplete and often impossible during the travel from the nozzles to the bottom. Continuous use of oil or other fuel is then required to obtain desirable results.

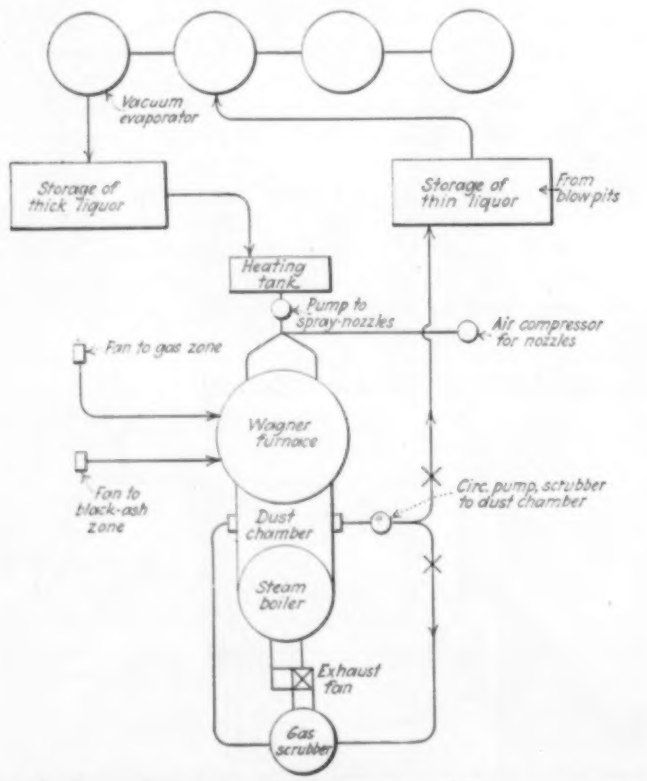


Fig. 2—Flow Sheet for Furnace Assembly and Recovery Process

REFERENCE to the sectional sketch in Fig. 1 and the flow-sheet in Fig. 2 should make sufficiently clear the manner in which the elements of the furnace equipment have been linked to meet the requirements just enumerated, to economize ground-space, and to make a compact and easily controlled reclamation unit.

In the belief that certain basic data concerning the composition, thermal value and heat-balance of average sulphate mill black-liquor is of interest, Table I is appended. The figures given in more or less round numbers closely approximate results when a normal mixture of sound woods is being pulped. The figure expressing the B.t.u. value of black-liquor organic solids is the result of tests on material obtained by drying out the liquor for several hours at 100 deg. C., and there is an undetermined but important loss of volatiles of high thermal value during this drying, such as alcohols, acetone, terpenes, and methyl mercaptans. Actual working experience indicates much greater steam production with this combustible than is shown in the calculated heat-balance.

Table I—Composition, Thermal Value and Heat Balance of Average Sulphate Mill Black Liquor

ANALYSIS OF THE LIQUOR

	Per Cent	Lb. per Gallon
Water Content	30	3.36
Organic Solids	42	4.72
Inorganic Solids	28	3.15

TOTAL B.T.U. VALUE

Burning 500 gallons of the above liquor per hour and assuming B.t.u. value as 8,260 per pound of organic matter, the total thermal product would be 4.72 × 8,260 × 500 = ... 19,493,000 B.t.u

HEAT LOSSES

Flue Gases

Air at 60 deg. F., flue gases at 500 deg. F., and using 12 lb. air per pound of organic solids for combustion, and air having specific heat 0.24, then; 4.72 × 500 × 12 × (500 — 60) × 24.... 2,990,600 B.t.u.

Water Content

3.38 × 500 × (1,050 + 250 deg. superheat) = 2,112,500 B.t.u.

Fusion of Inorganic Solids

3.15 × 500 × (1,800 — 60) × .24 = ... 657,700 B.t.u.

Reduction 250 lb. Na_2SO_4 to Na_2S and Fusion

250 × (1,800 — 60) × .24 + 3,048 B.t.u. per lb. = ... 870,000 B.t.u.

Radiation Losses

Estimated at 10 per cent of total heat generated = ... 1,949,300 B.t.u.

Total Heat Losses .... 8,580,000 B.t.u.

HEAT SALVAGED

Total Generated	19,493,000 B.t.u.
Total Lost	8,580,000 B.t.u.
Available for Steam	10,913,000 B.t.u.

STEAM VALUE

Boiler pressure 160 lb. Feed-water 195 deg. F. 1,032 B.t.u. per pound steam generated, then:

$$\frac{10,913,000}{1,032} = 10,574 \text{ lb. steam; and } \frac{10,574}{34.5} = 307 \text{ Boiler-hp.-hour.}$$

Penetrance of Oily Fluids in Wood

Studies of the effect of oil-peptized colloids on penetrance

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This article is the second part of a report on penetrance, the first part of which was published in Chem. & Met., *June, 1927. The work reported here is one phase of the investigations of the Wood Preservation Fellowship at the Mellon Institute, 1923-1927, supported by the Grasselli Chemical Co., Cleveland, Ohio.*

AN IMPORTANT recent development in the art of wood preservation has been the use of petroleum oils. These oils, usually residuum fractions, known as fuel oils, are not toxic to fungi and cannot be used alone. However, used as a supplementary treatment with zinc chloride and in admixture with coal-tar creosote, petroleum oils have effected economies and given very promising results. In the selection of a wood preservative its penetrance, or ease of injection into wood, is of prime importance and this is particularly true of petroleum oils.

It was pointed out in the earlier article that viscosity used as the sole criterion in determining the penetrance of oils is inadequate and used alone may sometimes be grossly misleading.

For example, penetrance experiments were described showing that certain petroleum oils and creosote-petroleum mixtures had a distinctly low comparative penetrance even though their viscosities were equal to or even lower than the viscosities of other penetrative oils.

Further investigational attention has been given to this subject and the influence of oil-peptized colloids in causing penetrance variations, independent of viscosity, has been demonstrated. It is quite possible that other factors not considered may also be of significance under other conditions.

In a continuation of the penetrance comparisons previously reported it was found that pure distillate petroleum oils, such as automobile cylinder oils, kerosenes, etc., and mixtures of these, were highly penetrative and at equal absolute viscosities were sensibly equal in penetrance.

Compared at a standard viscosity it was found that certain petroleum residuum fuel oils and also certain creosote-petroleum mixtures were equal to distillate petroleum oils in penetrance. On the other hand, certain petroleum residuums and creosote mixtures with these were, at the same standard viscosity, much less penetrative. Compared under standard treating conditions on 6x6x36-in. matched Douglas fir specimens, these non-penetrative oils and mixtures gave an absorption in the neighborhood of only one-tenth that of a distillate oil mixture of the same viscosity.

INDICATIONS during the preliminary work pointed to a colloidal explanation of such variation, and it has been possible to conclude that with the oils studied the penetrance variations were due to colloids present.

Of the oils studied a sample of Mexican Panuco crude petroleum and one of California residuum were found to have particularly non-penetrative properties.

As a preliminary experimental study, eight mixtures of distillate oil (lubricating oil and kerosene) with gradually increasing percentages of Mexican crude petroleum were prepared and compared as to penetrance on 1½x 1½x11 in. matched Douglas fir specimens. Viscosities were kept constant by varying the lubricating oil to kerosene ratio.

RESULTS of the penetrance comparison of these mixtures are shown in Table I and average adsorptions (penetrance) are plotted against the percentage of Mexican crude petroleum present in Fig. 1.

Table I—Effect of Increasing Concentrations of Mexican Crude Petroleum on Penetrance

(Mixtures were heated for twelve hours before impregnations)

Percentage of Mexican Crude Petroleum Present	Absorptions by Individual Matched Fir Specimens (grams)		Average Absorption (Penetrance)
0.0	.....	..	33
2.0	11-f	25	28
	11-n	29	
	11-e	29	
5.0	11-i	30	30
	11-d	34	
	11-k	27	
8.0	11-a	28	26
	11-e	26	
	11-j	25	
9.0	11-b	22	26
	11-j	22	
	11-p	28	
10.0	11-b	26	25
	11-m	25	
11.0	11-e	22	23
	11-e	25	
	11-j	23	
13.0	11-e	14	13.5
	11-a	13	
15.0	11-h	14	13
	11-h	14	
	11-f	11	
33.3	14-a	15	14
	14-k	14	
	14-g	13	

CALIFORNIA residuum dissolved in distillate oils had a similar effect on penetrance. The mixtures were prepared by blending a lubricating oil-kerosene mixture with a California residuum-California gas oil mixture of identical viscosity. Results for California residuum are presented as Table II and as Fig. 2.

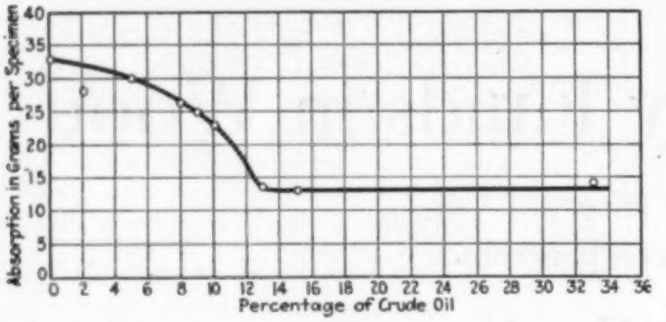

Fig. 1—Effect of Mexican Crude Petroleum on Penetrance

Magnesium oleate, because of its general use as an oil-peptizable colloid, was prepared and its effect on the penetrance of a lubricating oil-kerosene mixture containing it was determined. In conducting this series of tests, a mixture of lubricating oil and kerosene containing 10 per cent of magnesium oleate and of requisite viscosity was prepared. All other percentages of magnesium oleate were obtained by diluting the 10 per cent mixture with suitable quantities of a lubricating oil-kerosene mixture of the same viscosity.

Penetrance results are shown in Table III and in Fig. 3. The decrease in penetrance is very similar in kind and degree to that due to asphaltic petroleums.

Stearine pitch is a waxy still-residue from the vacuum distillation of fatty acids and is peptized by mineral oils to give a colloidal solution. Because of the known colloidal nature of oil solutions of this material and because of its similarity to asphaltic petroleums, its effect on penetrance was determined.

A decrease in penetrance with increasing concentration of pitch was observed, but the nature of the curve is different than for magnesium oleate. Results are presented in Table IV and plotted as Fig. 4.

Interesting preliminary experiments on the effect of suspended matter in conjunctiion with peptized colloids were carried out. For example, to a lubricating oil mixture containing 1 per cent of magnesium oleate, 2.5 per cent of gas black (carbon) was added, and the mixture was homogenized at 80-85 deg. C. A reasonably stable suspension of the gas black resulted.

On testing for penetrance in the usual manner, an average absorption of 35 g. per specimen resulted, which was equal to the absorption for pure lubricating oil. Carbon was filtered out on the wood surface.

The average absorption for the same 1 per cent magnesium oleate solution without gas black was 23.5 g. per specimen. The increase due to suspended gas black is readily explainable on a colloidal basis by the justifiable assumption that the absorptive gas black removed the peptized colloid, magnesium oleate.

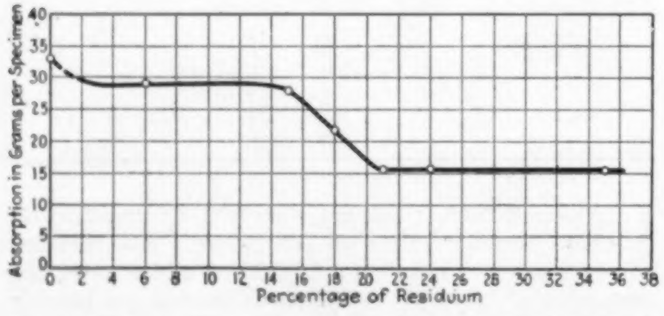

Fig. 2—Effect on Pentrance of Increasing Amounts of California Residuum Dissolved in Lubricating Oil-Kerosene Mixture

Homogenization of a 15 per cent solution of Mexican crude oil in lubricating oil with 5 per cent of gas black increased the penetrance, as measured by average absorptions of laboratory fir test specimens, in grams, from 15.5 to 23.5.

Table II—Effect of Increasing Concentrations of California Residium on Penetrance

Percentage of California Residuum In Mixture	Absorptions by Individual Matched Fir Specimens		Average Absorptions (Penetrance)
0.0	.....	..	33
6.0	11-n	30	29
	11-c	28	
15.0	11-0	19	28
	11-d	29	
	11-l	36	
	11-f	26	
18.0	11-e	19	22
	11-h	23	
	11-h	29	
	11-n	16	
	11-a	25	
21.0	11-e	16	15.5
	11-c	15	
24.0	11-i	16	16.0
	11-m	18	
	11-i	15	
	11-a	16	
36.0	11-o	16	15.5
	11-k	15	

Table III—Effect of Increasing Concentrations of Magnesium Oleate (Colloidal) on Penetrance

Percentage of Magnesium Oleate in Mixture	Absorption by Individual Matched Fir Specimens (Grams)		Average Absorptions (Penetrance)
0.0	.....	..	33
1.0	11-a	27	23.5
	11-k	20	
1.5	11-f	24	23.5
	11-o	23	
3.0	11-k	24	23
	11-n	20	
	11-b	24	
5.0	11-j	23	23
	11-o	20	
	11-a	26	
6.0	11-k	16	16
	11-f	14	
	11-m	17	
7.5	11-k	16	17
	11-d	18	
10.0	11-k	15	16
	11-p	18	
	11-b	16	

Table IV—Effect of Increasing Concentrations of Stearine Pitch on Penetrance

Percentage of Stearine Pitch in Distillate Petroleum Oils	Absorption by Individual Matched Fir Specimens (Grams)		Average Absorptions (Penetrance)
0.0	.....	..	33
0.5	11-e	29	30
	11-e	31	
1.0	11-b	24	28
	11-n	28	
	11-h	31	
2.0	11-b	20	21
	11-o	22	
	11-h	22	
3.0	11-c	17	17.5
	11-l	18	
5.0	11-e	15	16
	11-l	17	
	11-d	17	
10.0	11-k	13	16
	11-p	17	
	11-d	16	

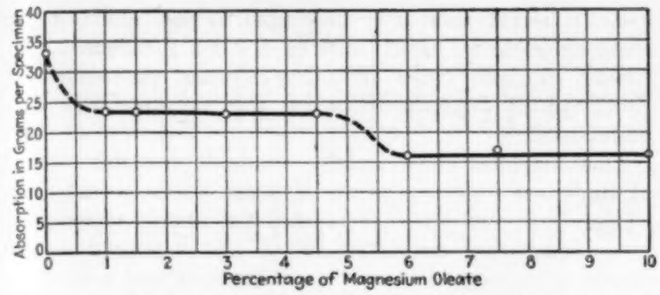

Fig. 3—Effect of Increasing Amounts of Magnesium Oleate in Lubricating Oil on Penetrance

THESE results may be summarized in the following manner:

1. A theory that the low penetrance of certain oils and tars in wood is due to peptized colloids present was suggested by work previously reported.

2. Experimental evidence lending credence to the colloidal explanation has been presented.

3. The theory gives an intelligent basis for the selection of petroleum products of high penetrance for wood impregnation. Also methods (patent protection has been allowed on some method of improving the penetrance of wood-impregnating oils) of improving oils of low penetrance, when necessary, by removal of colloidal matter, suggest themselves.

4. Time was not available to make a complete theoretical study of the mechanism of penetrance decrease due to oil-peptized colloids. A plausible hypothesis is that the colloids exert their influence by changing the capillarity relationship between oil and wood. No consistent relationship could be found between the surface tensions at an oil-air or at an oil-water interface and the penetrance of the oil.

5. Another important possibility in wood impregnation is suggested, namely: that "penetrance promoters" having an opposite effect to that of the colloids studied on the capillarity relationship between oil and wood may be developed.

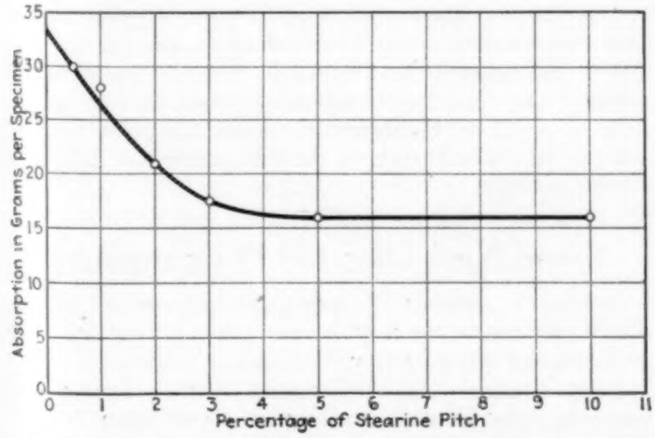

Fig. 4—Effect on Penetrance of Increasing Percentages of Stearine Pitch in Lubricating Oil

Coal Dust Explosions

In Bulletin 268, Bureau of Mines, George S. Rice, J. W. Paul and H. P. Greenwald summarize the long series of tests on coal dust explosions carried out at the Bureau's experimental mine from 1919 to 1924. This bulletin, priced 35 cents, can be procured by sending cash or money order to the Superintendent of Documents, Washington, D. C.

Three Electrode Vacuum Tubes As Chemical Engineering Equipment

This article is an abstract of a paper given by Harold C. Weber at the meeting of the American Institute of Chemical Engineers, Cleveland, May 31-June 3, 1927. The suggestions made therein as to the use of vacuum tubes in the control of chemical processes are important and significant. This new development no chemical engineer can afford to disregard

IN THE FIELD of chemical engineering, the three electrode vacuum tube has found uses more varied and at least as important as those discovered in other fields. It is being used for the analysis of gases; for the measurement of gas velocities that are lower than can be measured successfully with the pitot tube; for the measurement of pressures, particularly those that are high and suddenly developed as obtained in explosives; for the measurement of small distances of the order of magnitude of less than one hundred millionth of an inch; for the determination of certain characteristics of material such as dielectric constant and electrical resistivity and for producing high or variable frequency sine wave alternating current for laboratory and control work.

The number of devices available for industrial work is growing rapidly. Already one cable company is using the vacuum tube oscillator to follow the changes in rubber during vulcanization, a Boston manufacturer has apparatus available for controlling the thickness of coating materials and his device is being used by a number of manufacturers of rubber sheet goods to maintain automatically a constant thickness of rubber on cloth. A pulp mill is using a similar device for maintaining a constant amount of moisture in the pulp passing over the rolls of the pulp drying machines.

Industrial application has just begun and no doubt in a few years, the audion tube will hold a more important place in industry than now.

HALL AND ADAMS have pointed out the advantages of using the audion amplifier and oscillator as a method for obtaining the balance point in electrolytic conductivity measurements and Stose has found that the oscillating audion is a most satisfactory source of high frequency current for this purpose. Other experimenters have found that the vacuum tube may be very successfully used for the measurement of the small e.m.f. set up in electrometric titrations and by thermocouples used for the measurement of temperatures. In all cases of voltage measurement the vacuum tube offers the advantage that the current taken by the input circuit of the tube may be made as small as desired. This is a distinct advantage for most work as the effects of line resistance in the case of thermocouples, and of polarization effects in the case of electrolytic work are entirely eliminated. These uses might be considered as more applicable to the laboratory than to the plant but thermoelectric measurements and conductivity determinations

are becoming more and more useful in the plant. Only recently the sugar refiner has discovered that conductivity measurements offer an excellent means for determining the ash content of sugar solutions.

The frequency at which a given circuit oscillates is determined by the values of inductance and capacity included in this circuit. If a set-up be made and if air be used as the dielectric in the condenser a current of a certain frequency will be generated. If now the air be withdrawn from the condenser and another gas be substituted, a current of a different frequency will be generated, because the dielectric constants of the various gases have different values. Such an instrument may be calibrated in terms of a mixture of two gases and then forms a method of analyzing this mixture for the amount of each gas present. By combining the measurements of such a circuit with other measurements as for instance those made with an Orsat apparatus, mixtures of more than two gases may be analyzed.

OSCILLATING circuits offer several methods of determining pressures. The dielectric constant of most gases is a straight line function of the pressure, increasing with increasing pressure. Since this is true, it can be seen that a device similar to that indicated for the analysis of gases will serve as a pressure gage since the change of dielectric constant with pressure will cause a change in frequency in the oscillating circuit and this in turn may be calibrated in terms of pressure. A second method of pressure measurement would consist in making the condenser serve as a compression member so that the applied pressure would vary the distance between the two plates and in this way cause a change in the frequency of the currents being generated. An English experimenter, working with such a device, has been able to detect the bending of an oak table top an inch and a half thick when subjected to the load of one English penny. Whiddington reports measuring distances down to less than one two hundred millionth of an inch.

A third method of pressure measurement involves the use of so-called "piezo electric" crystals. If certain crystals be cut along the proper axis and then subjected to pressure along this axis, an electric charge will collect on the surface of the crystal. This is true especially of the quartz crystal. The size of the charge is a function of the pressure applied. A vacuum tube coupled to such a device offers an excellent pressure gage. This method might be used for the measurement of pressures developed in the discharge of guns and has been so used in a slightly modified form. It would seem to be an excellent method of following the explosion in an internal combustion engine. There would be no lags in the indicator and a permanent record might be obtained.

SOME DEVICE for the measurement of small pressure differences is needed especially in connection with pitot tubes and venturi meters. At present there seems to be no simple, cheap and reliable apparatus available for the determination of very low gas velocities. The anemometer is not accurate and pitot tubes with gages having a high multiplication factor are unreliable. The oscillating tube with its high sensitivity to changes in capacity seems to offer a most promising answer to this problem. It will only be necessary to cause the small pressures set up to vary the frequency in an oscillating circuit and then to convert these to velocity changes.

Oscillators of all types may be purchased ready to use. It is for each user to couple to the oscillator the registering device most suitable for his problem. This should in most cases be fairly simple, providing the fundamental characteristics of the vacuum tube are understood.

One machine commercially available for the control of thickness or composition of sheet goods works on a slightly different principle from those already mentioned. If an oscillating circuit be set up and a second simple circuit consisting of merely an inductance and a capacity be set up near the first circuit, then the amount of current transferred to the second circuit by induction will depend on how nearly the second circuit is in tune with the first circuit.

IN THE commercial apparatus, a current of constant high frequency is generated by means of a vacuum tube. A second circuit is made up of an inductance and a capacity. The capacity consists of two metal plates between which the material to be controlled passes. Variations in the composition or thickness of the material passing between the plates will cause a change in this capacity which in turn will cause a change in the amount of current being picked up from the constant frequency circuit. It is merely necessary to cause this change in current to actuate a control mechanism to obtain a uniform product. Such an arrangement is far superior to hand control and is so sensitive that most of the machines so far installed have had to be damped in order to decrease their sensitivity.

If instead of allowing the product to pass between the plates of the condenser, these plates are held apart by some material sensitive to moisture changes, then changes in moisture will cause a change in the distance between the plates. This gives a sensitive method for determining or for controlling moisture, as changes in the plate spacing mean capacity changes that are indicated by changes in the current flowing in the measuring circuit. A moisture control device of this sort is in use on some paper pulp machines and has proved to be very reliable and sensitive. Merely allowing the moist pulp to pass over the sensitive strip is sufficient to actuate the machine. By varying the material in the sensitive strip this scheme may be adapted to many other uses. Thus a strip sensitive to hydrocarbon vapors might be used to control the concentration of these vapors in the drying of rubber goods.

Some New Uses for Permanganate

Among a number of new and interesting uses to which permanganate may be put, as for instance, with soja bean oil a good waterproof glue is obtained.

Seed potatoes may be treated with a 5 per cent permanganate solution to protect them from fungus. The corrosive sublimate ordinarily used is poisonous to live stock, and metal containers, such as pails, cannot be used because the mercury deposits on them. Manganese is necessary for the growth of leaves, and a lack of manganese causes blight in such vegetables as spinach. A dip in manganese sulphate is also recommended to increase potato yield.

Permanganate added to the rain water in a barrel used in camp for washing purposes effectively prevents the development of mosquito larva in the barrel; and sprinkled in low places around the camp reduces the number of mosquitoes in the immediate neighborhood.

Acid Resistance of Vacuum Melted Alloys Containing Nickel

By Dr. W. Rohn
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Hanau, Germany

EDITOR'S NOTE. *This article, which appeared originally in the* Zeitschrift fur Metalkunde *for December, 1926, has been translated, condensed and revised for* Chem. & Met.'s *use by C. B. Backer of Backer & Amlie, engineers, 200 Fifth Avenue, New York, who are the representatives of the Heraus Vacuumschmelze in America and Canada. The marked acid resisting properties imparted to alloys produced by the electric vacuum melting process makes this article of unusual interest to the chemical engineering industries.*

SEVERAL YEARS of experimental work in the research laboratories of Heraus Vacuumschmelze, who employ the electric vacuum melting of alloys on a large industrial scale, has resulted in the accumulation of considerable information regarding the corrosion resisting properties of these metals and alloys. It is of particular interest that several of the alloys investigated can not be produced in a workable and ductile form except by the vacuum melting process.

As the main constituents of ductile, acid resisting alloys the metals considered in this experimental work were: iron, nickel, cobalt, copper, chromium, molybdenum and tungsten. Table I on pages 418 and 419 starts with the acid resisting properties of these seven pure metals when exposed to 10 per cent solutions of nitric, sulphuric, hydrochloric, acetic and phosphoric acids. The figures in the tables denote the loss in weight in grams per square decimeter of the exposed surface. The metals and alloys in question have all a specific weight of about 8, which means that 1 dm^2 sheet 1 mm. thick weights about 80 grams. For instance a loss in weight of 8 grams per dm^2 means that the sheet has been consumed to a depth of 0.1 mm. A loss in weight of 0.1 gram per dm^2 in 24 hours means that it would take 800 days to corrode the surface of the sheet to a depth of 1 mm.

The metals investigated were of the greatest possible purity and were all melted and cast into ingots in vacuum. The test sheets were first hot rolled and finally cold rolled, except the specimens of pure molybdenum, pure tungsten and pure cobalt, which were only hot rolled. One half of the specimens were tested as cold rolled un-annealed and the other half were annealed at 950 to 1,000 deg. C. To avoid trouble from surface layers and scale all of the test sheets were thoroughly brightened with emery cloth, but were not otherwise polished.

Of the pure metals studied, iron (No. 1 in Table I, pp. 418-9) is strongly attacked by all of the acids in question. It is included in the table to provide a convenient comparison between it and the other metals investigated. Nickel (No. 2) resists sulphuric, acetic and phosphoric acids and is fairly satisfactory against hydrochloric acid, but rather poor against nitric acid. Cobalt (No. 3) is badly attacked by nitric acid, but is fairly resistant to the other acids, although, on the whole, far inferior to nickel. Copper (No. 4) is strongly attacked by nitric, but resists the other acids. Chromium (No. 5) test specimens were made by sawing out sheets from a vacuum melted ingot of electrolytic metal, 99.8 per cent pure. It is of excellent resistance against nitric and phosphoric acids, fairly good against acetic acid, but remarkably poor against hot sulphuric acid. Cold sulphuric on the other hand has very little effect on pure chromium so prepared. Hot hydrochloric acid attacks chromium five times as fast as it attacks iron, and in cold hydrochloric, chromium is about a hundred times as rapidly dissolved as iron. Molybdenum (No. 6), which was investigated in the form of hot rolled sheets, is poorly resistant to nitric acid, but good against the other acids. Tungsten (No. 7) is fairly resistant to nitric acid, and good against sulphuric and hydrochloric acids.

Chromium-Iron Alloys. Numbers 8 to 20 in Table I show the properties of chromium-iron alloys with or without nickel, manganese, molybdenum and carbon. A 16 per cent chromium content (No. 8) provides an alloy which is practically un-attacked by cold or hot nitric acid. Sulphuric and hydrochloric acids attack it strongly even in the cold. It is strange that the un-annealed alloy is not affected by phosphoric acid, while the annealed specimen is strongly attacked by this acid.

Numbers 9 and 10 are two well-known commercial alloys which contain small amounts of nickel, silicon and manganese. They are not quite as resistant as No. 8 to nitric acid, but very much better against sulphuric and hydrochloric acids. These two alloys also resist acetic and phosphoric acids.

Number 11 has 25 per cent of chromium and is somewhat better than the 16 per cent alloy against sulphuric, hydrochloric, acetic and phosphoric acids. Against hot sulphuric acid the 25 per cent chromium-iron is about as good as the commercial alloy containing 15 per cent Cr and 1 or 2 per cent Ni. Against hydrochloric acid the 15 per cent Cr alloy with a small amount of Ni is better than the 25 per cent chromium-iron alloys without nickel.

By a comparison of alloys 8, 11 and 13 it may be seen that an addition of 1 per cent of manganese more than counterbalances the resistance obtained by a 9 per cent increase in the chromium content. This fact is of importance because these alloys are as a rule de-oxidized with manganese or silicon. It will be appreciated, therefore, that silicon alone, and not manganese, should be used as de-oxidizer in such alloys.

A comparison of the alloys 11 and 12 shows that 0.25

Table I—Loss in Weight in Grams per Square Decimeter

No.	Composition											Nitric Acid 10 Per Cent					Sulphuric Acid 10 Per Cent				
	Fe	Ni	Co	Cu	Cr	Mo	W	Mn	Si	Al	C	1 hr. cold	2 hrs. cold	24 hrs. cold	1 hr. hot	24 hrs. hot	1 hr. cold	2 hrs. cold	24 hrs. cold	1 hr. hot	24 hrs. hot
1	100											....	33.0 32.5	....	40.0 36.7	....	0.06 0	 0	1.1 0.24	21.7 15.6	....
2		99.5						0.5				....	....	0.65 0.50	3.7 9.07	....	....	....	0.04 0.01	0.04 0.02	0.08 0.10
3			99.5					0.5				....	....	10.7	27.3	....	....	....	0.06	0.30	....
4				100								....	....	3.1 2.5	21.3 20.8	....	....	....	0.017 0.010	0.014 0.018	....
5					100							....	....	0.013	0	....	....	....	0.01	45.	....
6						100						....	....	5.2	1.8	....	....	....	0.006	0.0015	0.03
7							100					....	....	0	0.06	....	....	....	0	0.01	....
8	84				16							0	0	0 0	0 0	0 0.04	1.6 0.52	3.4 1.1	9.5 7.5	47. 32.	....
9	82	0.7			15			0.5	0.8		0.2	....	....	0 0	0.007 0.01	....	....	....	4.4 5.4	19.5 24.	....
10	82	2			15			0.4	0.5		0.15	....	....	0 0	0.003 0.003	....	....	....	4.7 4.3	15.6 14.4	....
11	75				25							0	0	0 0	0 0	0.003 0.003	0.6 0.25	.... 0.48	11.9 9.6	22. 19.	....
12	74				25						0.25	....	....	0.05 0	0.2 0.009	....	....	3.1	27.6 6.	108. 56.3	....
13	74				25			1				0 0	0	0 0	0 0	....	2.3 0.9	4.6 1.7	13.4 7.5	57.3 42.9	....
14	74				25				1			....	....	0.005 0	0.005 0	....	0.83 0.7	1.6 1.4	15.2 6.5	60. 76.	....
15	68				32							....	....	0.006 0	0 0	....	....	....	13. 18.	64.8 57.6	....
16	50				50							....	....	0.002 0.002	0.004 0.004	....	....	....	45.6	52.8	....
17	71	8			20			0.26	0.29		0.22	....	....	0 0.001	0.001 0.001	0.001 0.001	....	....	0.007 0.003	2.62 2.53	....
18	55	20			25							0	0	0 0	0 0	....	0.06 0	 0	0.12 0.12	1.8 1.7	....
19	50	35			15							....	....	0.24 1.8	0.05 1.5	0.03 2.8	....	....	0.15 0.14	0.08 0.15	....
20	70				25	5						....	0	0.2 0	0.02 0	....	....	0.07	0.08 0.82	2.8 3.81	....
21		88			11			1				....	0.6	2.76 2.37	2.16 0.9	....	....	0	0.03 0.02	0.12 0.05	....
22	20	64			15			1				....	0.6	0.6 0.19	0.12 0.02	....	....	0	0.12 0.03	0.06 0.11	5.5 4.3
23	20	63			15			1			0.9	....	....	24.6	49.2	....	....	....	0.1	0.49	....
24	20	65			15							....	....	0.065 0.040	0.0025 0.0025	0.16 0.36	....	....	0.002 0.006	0.020 0.015	0.57 0.41
25		84			15			1				....	....	0.04 0.04	0 0.2	....	....	....	0.07 0.01	0.10 0.02	....
26	10	69			20			1				....	....	0.01	0.02 0.26	0.01 0.28	....	0.02	0.14 0.02	0.09 0.06	....
27		79			20			1				....	....	0.01 0.02	0 0	....	....	....	0.01 0.01	0.11 0.14	....
28	9	65			25			1				....	....	0	0 0.01	0.06 0.02	....	0	0.03 0.02	0.12 0.06	....
29	16	50			33			1				....	0	0 0.01	0 0	....	....	0	0.03 0.02	0.31 0.01	....
30	19,5	61			15	2,5		2				....	....	0.018 0.02	0.003 0.02	0.003 0.004	....	....	0.024 0.04	0.027 0.05	0.08 0.12
31	18	61			15	4		2				....	....	0.003 0.013	0.005 0.005	0.005 0.005	....	....	0.015 0.02	0.010 0.013	0.08 0.06
32	18	60,4			15	4		2			0.57	....	....	5.1	0.78	....	....	....	0	0	....
33	20	61			15	4						....	....	0.008 0.011	0.025 0.0025	....	....	....	0.005 0.009	0.025 0.027	....
34	15	61			15	7		2				....	....	0.05 0.01	0.02 0	0.056 0.056	....	....	0.06 0.01	0.03 0.02	0.12 0.05
35	15	51			25	7		2				....	....	0.03	0.05	....	....	....	0	0.045	....
36	16	61			15		6	2				....	....	0.06 0.08	0.01 0.01	....	....	....	0.03 0.02	0.02 0.02	....
37	12	61			15		10	2				....	....	0.016 0	0.02 0.012	....	....	....	0.008 0.008	0.02 0.025	0.12 0.1
38	14	58	3		15	3	5	2				....	....	0.008 0.008	0 0	0.008 0.008	....	....	0.008 0.004	0.012 0.012	0.18 0.16
39	17	61			15			2		5		....	....	0.28 0.26	0 0	....	....	....	0.07 0.05	0.34 0.22	....
40			90		10							....	....	12.9 9.5	15. 17.3	....	....	....	0.027 0.012	2.7 2.4	....
41		40		60								....	....	0.06 0.24	19.4 7.6	....	....	....	0.005 0.01	0.003 0.012	0.09 0.15
42	2.5	68		27				2.5				....	....	0.044 0.02	1.2 0.73	....	....	....	0.016 0.012	0.008 0.004	0.11 0.15

per cent carbon has a bad effect on the resistance of the alloy against sulphuric and nitric acids, while there is practically no effect from the carbon against cold hydrochloric acid. Alloy 12, containing 0.25 per cent carbon, belongs to the group of alloys which may be tempered and was therefore tested both in the form of a slowly cooled specimen and as a quenched specimen. The quenched test sheet showed far better acid-resisting properties than the one which was slowly cooled.

Numbers 15 and 16 show that an increase in the chromium content to 32 per cent and 50 per cent does not improve the alloys. It is, however, of interest that the alloys with up to 50 per cent chromium may be perfectly rolled and drawn provided they are absolutely free from carbon.

Alloy No. 17 represents a well-known rustless steel with 20 per cent Cr and 8 per cent Ni. An increase in the chromium and iron contents is in general injurious.

Number 20 is an alloy with 25 per cent Cr and 5 per cent Mo, which is excellent against chlorides and hydrochloric acid, but since approximately the same properties may be attained by adding nickel instead of molybdenum, and as alloys containing nickel are easier to draw and roll and cheaper in price, there remains little reason for using molybdenum in the chromium-iron alloys.

for Vacuum-Melted Metals and Alloys When Exposed to Various Acids.

No.	Hydrochloric Acid 10 Per Cent					Acetic Acid 10 Per Cent				Phosphoric Acid 10 Per Cent				Heat treatment	Trade designation
	1 hr. cold	2 hrs. cold	24 hrs. cold	1 hr. hot	24 hrs. hot	1 hr. cold	2 hrs. cold	24 hrs. cold	1 hr. hot	1 hr. cold	2 hrs. cold	24 hrs. cold	1 hr. hot		
1	0,12		0.5	33.8				0.14	0.79			0.27	5.77	Un-annealed	
		0	0.12	21.0				0.21	0.76			0.14	12.3	Annealed	
2			0.025	0.47				0	0.012			0.004	0.036	Un-annealed	
			0.04	1.51				0.004	0.004			0.004	0.004	Annealed	
3			0.08	2.3				0.04	0.15			0.06	0.7	Hot rolled	
4			0.08	0.05				0.01	0.021			0.01	0.01	Un-annealed	
			0.07	0.05				0.004	0.025			0.017	0.014	Annealed	
5			77.4	150.				0.13	0.03			0	0	Slowly chilled	
6			0.01	0.0015	0,08			0.02	0.003			0.03	0.009	Hot rolled	
7			0	0.01										Hot rolled	
8	3.6	6.8	35.	70.				0	0.10			0	0	Un-annealed	
	0.55	1.2	6.5	27.				0.03	0.024			0.04	2.44	Annealed	
9			0.78	16.3				0	0.003			0	0.003	Un-annealed	V 5 M
			0.78	25.5				0	0.018			0	0.003	Annealed	
10			0.19	4.5				0	0.003			0	0.003	Un-annealed	V 1 M
			0.30	10.8				0	0.003			0.003	0.006	Annealed	
11	1.4	2.7	12.3	26.				0	0			0	0	Un-annealed	
	0.5	1.2	6.2	14.				0	0.003			0	0.003	Annealed	
12		1.9		45.8										Slowly cooled	
			1.2	28.5										Quenched	
13	4.6	7.3	79.5	63.6				0	0.004			0	0.004	Un-annealed	
	1.1	2.4	70.5	40.				0	0.0056			0	0.004	Annealed	
14	0.54	1.1	148.	25.				0	0.005			0.014	0.007	Un-annealed	
	0.6	1.2	56.	94.				0	0			0	0	Annealed	
15			18.5	62.6				0	0			0	0.003	Un-annealed	
			17.	57.6				0	0			0	0	Annealed	
16			11.5	30.5				0	0			0	0.003	Un-annealed	
			15.8	43.2				0	0			0	0.003	Annealed	
17			0.27	1.34				0	0.002			0	0.003	Un-annealed	V 2 A
			0.25	1.55				0	0.005			0	0.005	Annealed	
18	0		1.0	19.0				0	0.01			0	0.015	Un-annealed	
	0	0	0.12	3.4				0	0			0	0.005	Annealed	
19			0.26	0.96				0.008	0.035			0.006	0.1	Un-annealed	Ferron
			0.32	0.30				0.012	0.026			0.016	0.29	Annealed	
20		0,04	0.34	1.40										Un-annealed	
			0.15	0.49										Annealed	
21		0.06	0.18	1.26				0.002	0.007			0.004	0.018	Un-annealed	Ao Chroman
			0.10	1.20				0.002	0.007			0.004	0.03	Annealed	
22		0.06	0.12	3.24	38.4			0.012	0.02			0.002	0.056	Un-annealed	B Chroman
			0.14	1.97	40.			0.016	0.01			0.008	0.062	Annealed	
23			0.3	0.26										Slowly chilled	
24			0.020	0.26	9.									Un-annealed	
			0.025	0.18	9.1									Annealed	
25			0.08	1.20				0.006	0.004			0.006	0.034	Un-annealed	Bo Chroman
			0.04	0.51				0.004	0.004			0	0.032	Annealed	
26		0.06	1.44	1.66				0.005	0.005			0.01	0.11	Un-annealed	C Chroman
			0.08	1.72				0.005	0.005			0.045	0.05	Annealed	
27			0.03	0.72				0.002	0			0.002	0.011	Un-annealed	Co Chroman
			0.03	0.68				0.002	0			0.004	0.051	Annealed	
28		0	0.42	3.84				0	0.008			0.002	0.08	Un-annealed	D Chroman
			0.13	2.65				0	0			0	0.16	Annealed	
29		0.06	0.36	4.2				0	0			0	0.011	Un-annealed	E Chroman
			0.09	3.51				0	0			0	0.008	Annealed	
30			0.05	0.027	2.7			0.008	0.02			0.012	0.002	Un-annealed	B 2, 5 M Contracid
			0.05	0.03	8.2			0.008	0			0.016	0	Annealed	
31			0.03	0.037	2.9			0.003	0.005			0.005	0.002	Un-annealed	B 4 M Contracid
			0.043	0.027	1.8			0.008	0.002			0.008	0.005	Annealed	
32			0	0.58										Slowly chilled	
33			0.04	0.08										Un-annealed	
			0.03	0.05										Annealed	
34			0.07	0.06	9.6			0.008	0.004			0.02	0.02	Un-annealed	B 7 M Contracid
			0.01	0.02	3.1			0.002	0.006			0.012	0.016	Annealed	
35			0	0.56										Un-annealed	
														Annealed	
36			0.05	0.20				0.0025	0.002			0.02	0.028	Un-annealed	B 6 W Contracid
			0.03	0.18				0.0025	0.002			0.02	0.03	Annealed	
37			0.012	0.12				0.002	0.002			0.016	0.02	Un-annealed	B 10 W Contracid
			0.004	0.12				0.002	0.002			0.018	0.02	Annealed	
38			0.024	0.07	2.7			0	0			0	0	Un-annealed	BWMC Contracid
			0.028	0.064	2.2			0	0			0	0	Annealed	
39			0.27	6.7				0.004	0.004			0.06	0.024	Un-annealed	
			0.26	6.5				0.014	0			0.068	0.016	Annealed	
40			0.13	1.5										Un-annealed	
			0.06	1.2										Annealed	
41			0.052	0.11	1.1			0.004	0.002			0.004	0.01	Un-annealed	Konstantan
			0.073	0.29	1.4			0.002	0.004			0.002	0.008	Annealed	
42			0.06	0.17	3.6			0.002	0.006			0.006	0.016	Un-annealed	Monel
			0.04	0.23	4.2			0.004	0.004			0.002	0.01	Annealed	

Alloys with Nickel as Principal Constituent. Numbers 21 to 29 represent alloys with nickel as the main constituent and, previously these alloys have been used principally as electric resistance alloys. Excepting No. 21 these alloys are fairly resistant to nitric acid, although not nearly as good as the chromium-iron alloys. Against sulphuric acid, on the other hand, they are far better than the alloys previously described, while against hydrochloric acid they are about the same as numbers 17, 19 and 20. The effect of carbon is shown in No. 23 which has 0.9 per cent C. The resistance against nitric acid is decreased greatly by the carbon. Against sulphuric acid it remains about the same as of the carbon-free alloys. Against cold hydrochloric it is somewhat poorer, but against hot hydrochloric considerably better.

Alloys like No. 22 generally contain 1 to 2 per cent Mn in order to improve the rolling and drawing properties. No. 24 is an alloy free from Mn. It will be noticed that the manganese-free alloy is from five to ten times as resistant to acids as those containing even a very small amount of Mn. Alloys numbers 30, 31 and 34 are of the same class as No. 22, but a part of the iron has been replaced by molybdenum. The best of these alloys, No. 31, contains 4 per cent Mo, 15 per cent Cr and 61 per cent Ni. It is nearly as resistant as chromium-iron alloys against nitric acid, about 200

times as good against sulphuric acid, and 40 times as good against hydrochloric. It is also resistant to acetic and phosphoric acids.

Alloys 31 to 38 are the most acid resisting commercial alloys so far produced in ductile and workable form such as bars, wire, sheet and tubing. They are also among the best alloys known in their oxygen resisting properties at high temperature. The electric resistance of these alloys is higher than that of the ordinary 80/20 nickel-chromium alloy, and their mechanical strength and elastic limit at high temperature are several times as great as that of the usual nickel-chromium alloys. (See Figs. 1, 2 and 3).

Mechanical Properties. In Figs. 1, 2 and 3 are given the ultimate strength, elastic limit, elongation, reduction of area and the notched bar tenacity for alloys Nos. 22, 34 and 37 at different temperatures up to 500 deg. It will be noted that the addition of molydenum or tungsten improves the elastic limit of the alloy to a remarkable extent. The ultimate strength is also considerably increased.

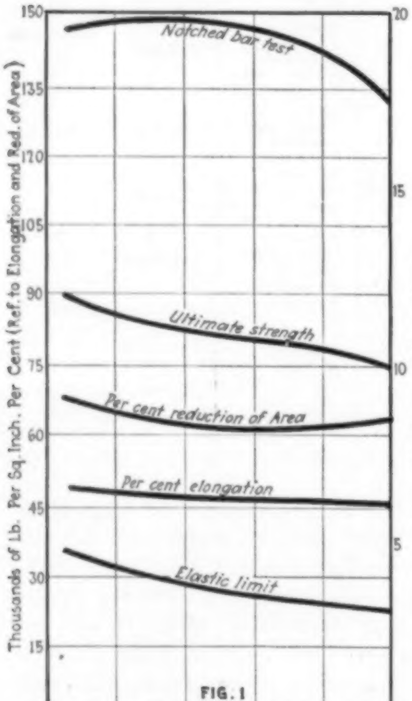
An important attribute of these alloys is that they are practically insensible to heat treatment. The notched bar test, which is probably the sharpest criterion for this, shows less than 5 per cent difference in tenacity between specimens which are very slowly cooled and others which are quenched when at temperatures from 850 to 1,100 deg. C. Unlike the well-known rustless steels the above alloys may easily be brazed with brass, silver or gold.

These alloys have unusually great resistance against erosion, and show practically no wear even after several months' use for such parts as pulverizer housings and exhaust nozzles exposed to hard wear. That the vacuum-melted nickel-chromium-molybdenum alloy, having an elastic limit of up to 100,000 lb. per sq.in. at a temperature of 500 deg. C., is excellent material for such parts as exhaust valves for airplane engines is apparent. Another important application is for seamless drawn pyrometer tubes of any length and diameter. These tubes may be used for temperatures up to 1,250 deg. C., and, practically speaking, they are resistant for all of the usual commercial acids.

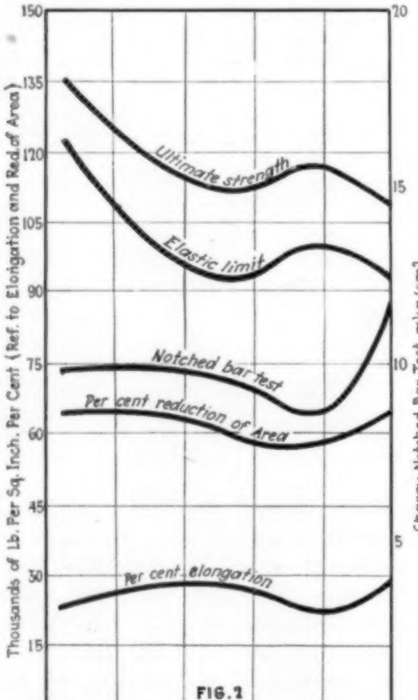
IT SHOULD BE BORNE in mind that the results of investigations of this nature must be used only as a guide. The figures given in the tables have, of course, a factor of uncertainty. Furthermore it must be remembered that the acids used were pure, while in practice the acids often contain impurities which may affect the corrosion to a great extent. It will also be appreciated that the loss in weight during a 24-hr. test is not a direct measure from which one may calculate the exact loss if the test were continued for months or years. Often there is a comparatively great loss during the first few hours and very little or no loss later on. It may also be the other way around.

In practical use it is of the greatest importance that the alloy becomes evenly corroded and not consumed in spots. A comparatively large loss in weight of an evenly corroded alloy may signify a better material for practical purposes than a much smaller loss in weight of an alloy which is corroded in spots. It is, therefore, a paramount necessity that the structure of the alloy should be even, and that it shall contain no impurities, such as iron oxide, which separates out in an uneven manner on the boundaries between the crystals.

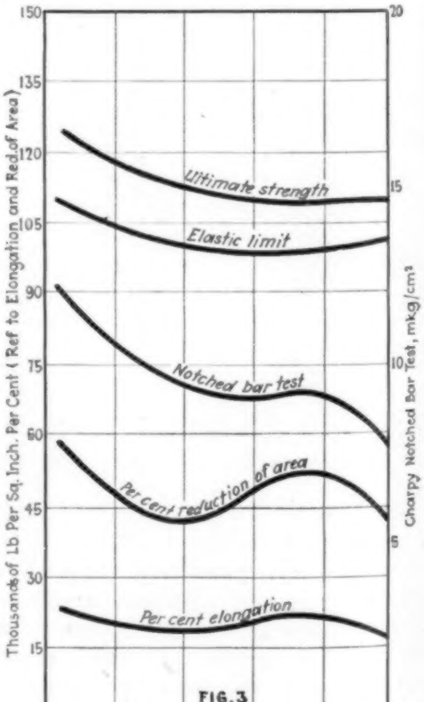
In producing ductile alloys of uniform composition and even grain structure, which are free from oxides, gases and other impurities, the perfected electric vacuum melting process has filled a great want in the metallurgical field.



Alloy B
No. 22 in table I
15% Cr, 64% Ni,
20% Fe, 1% Mn.



Alloy B7M
No. 34 in table I
15% Cr, 61% Ni,
15% Fe, 7% Mo, 2% Mn.



Alloy B 10 W
No. 37 in table I
15% Cr, 61% Ni,
12% Fe, 10% W, 2% Mn.

Figs. 1 to 3—Mechanical Properties at Different Temperatures up to 500 deg. C.

Practical Application of Inhibitors in Pickling Operations

Addition of small quantities of various organic substances shown to result in saving of acid, to preserve metal surface and to reduce fumes

By F. N. Speller and E. L. Chappell

Respectively, Metallurgical Engineer, National Tube Co., and Research Associate, Chemical Engineering Department, Massachusetts Institute of Technology

THAT the addition of certain substances which may be called inhibitors to an acid solution greatly decreases its rate of attack on metals without markedly slowing down the rate of solution of rust or scale, has long been known and utilized in industry. There has been, however, very little published in the technical literature on this subject and it seems worth while to describe something of the nature of these substances and to give data as to their action. To show the practical results which may be attained, tests of the application of inhibitors to a large scale pipe pickling operation are reported.

In general the primary action of an inhibitor is to decrease the rate of attack of an acid solution upon a metal, as for example the dilute sulphuric acid used for removing mill scale from steel pipe. The curves of Fig. 1 illustrate this action. It is seen that one square centimeter of steel surface in a 34 per cent H_2SO_4 solution at 25 deg. C. gives off 6 cc. of hydrogen in about thirteen hours while if 1 per cent of nitrogen bases is added to the solution 1,350 hours or about two months is required to give off the same amount of hydrogen. These data also show the typical increasing effectiveness of increasing concentration of inhibitors. This great decrease in acid attack on the metal is accompanied by only a slight decrease in activity toward rust and scale.

Effect of Temperature.—The rate of acid attack on metals increases rapidly with temperature, other conditions being constant. This is, in general, true of acid solvents whether containing inhibitors or not. At the higher temperatures there is a tendency for inhibitors to break down chemically, this temperature being quite different for the different inhibitors. It is necessary, therefore, to test any inhibitor at the temperature at which it is desired to use it.

Concentration of Inhibitor.—The increasing effectiveness of increasing concentrations of nitrogen bases has been pointed out in connection with Fig. 1. This is characteristic of all types of inhibitors. For example, plotting the data of Fig. 1 in the form of hydrogen evolution rate against concentration as shown in Curve A of Fig. 3 it is seen that the first additions of inhibitor make enormous decreases in hydrogen evolution rate and further additions, while making large percentage decreases in rate, yet have little practical advantage. Accordingly, for commercial purposes it is desirable to determine the curve corresponding to Curve A of Fig. 3 and then choose a working concentration taking into consideration the economic factors of cost and working time. For commercial pickling acids used dilute at a high temperature, a much smaller percentage decrease in hydrogen evolution rate with small additions of inhibitor will be found. Then the curve will not be so sharp. This is illustrated by the data for Curve B of Fig. 3. In this case 8 grams/liter was chosen as a plant concentration and a test is given in No. 10 in Table II.

Classes of Inhibitors.—Study of the literature shows widely scattered references to a large number of substances which have been used as inhibitors. Such materials as arsenic, barium, lead, cyanides, glue, flour and formaldehyde are mentioned.

Tests show that a very wide variety of organic substances have more or less effectiveness as inhibitors. This is illustrated by the data of Fig. 4. Consideration of these data has failed to indicate any very definite rela-

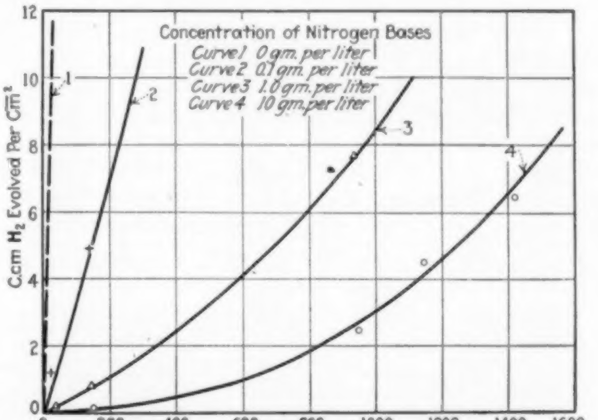


Fig. 1—Effect of Inhibitors on Steel in 34 per cent Sulphuric Acid at 25 deg. C.

A paper presented before the American Institute of Chemical Engineers at its meeting in Cleveland, Ohio, May 31-June 2, 1927.

Table I—Laboratory Test of Scale Removal to Determine Acid Consumption With and Without Inhibitors

Experiment 1
70 Deg. C.
4 Sq.Cm. Steel in 6 Per Cent H_2SO_4

	No Inhibitor	1.0 Gram/Liter of Nitrogen Bases
Weight of bare sample, gm	13.202	12.291
Weight of oxidized sample, gm	13.315	12.455
Weight of oxygen in scale	0.113	0.164
Pickling time, min	19	40
Hydrogen evolved over acid at 20 deg. C., cc	70	3
Iron equivalent to H_2, gm	0.079	0.0034
Weight after pickling, gm	12.743	11.769
Weight of iron removed, gm	0.459	0.482
Acid wasted in dissolving steel compared to acid used in dissolving scale, per cent	21	0.7

Experiment 2*
90 Deg. C.
125 Sq.Cm. Steel in 3 Per Cent H_2SO_4

	No Inhibitor	3.7 Gram/Liter of Acid Sludge
Pickling time, min	19	60
Total loss in weight, gr	4.5622	1.3652
Volume H_2 evolved, cc	1,440	130
Iron equivalent to H_2, grs	3.180	0.296
Total iron in solution (by titration), gr	4.226	1.099
Iron as oxide, gr	1.046	0.803
Oxygen in scale	0.341	0.266
Acid wasted in dissolving steel compared to acid used in dissolving scale, per cent	302	37

*From Undergraduate Thesis of José de Martino, M.I.T. 1926.

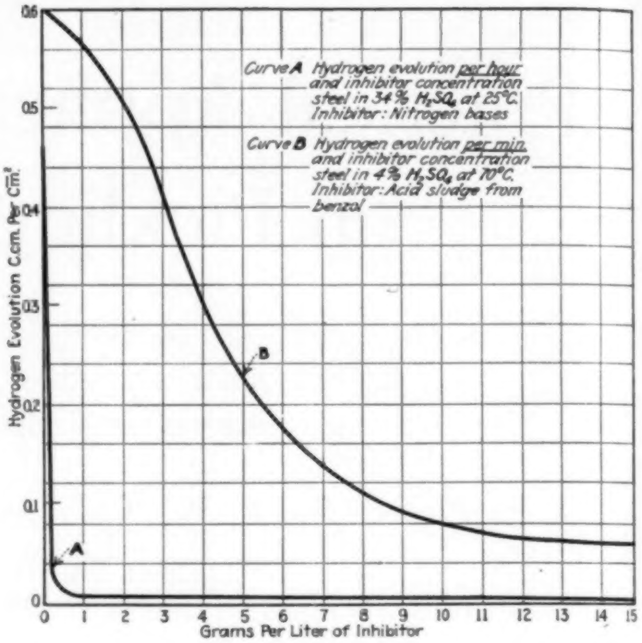


Fig. 3—Effect on Hydrogen Evolution of Increasing Concentration of Inhibitors

tion between chemical condition or properties and inhibitor effectiveness. For example it had been thought that since animal poisons such as arsenic and the cyanides are effective inhibitors, nicotine should be a good inhibitor. However, it is seen to be quite poor.

The increasing inhibitory effectiveness of the following series is notable: Aniline, $C_6H_5NH_2$; pyridine, C_5H_5N; quinoline, C_9H_7N; and quinoline ethiodide, $C_9H_7NIC_2H_5$. From this series the effectiveness of an inhibitor might be considered as increasing with increasing basicity or increasing molecular weight. It is seen from the curves of Figs. 1 and 3 that exceedingly small quantities of inhibitors are very effective. It has already been mentioned that several inhibitors are violent animal poisons. In addition several of these substances, such as arsenic and pyridine, are known to have a marked effect in certain catalytic processes. The combination of these observations seems to justify placing the action of inhibitors in the general class known as catalysis. As will be shown in a paper to be published later inhibitors have strong electrochemical effect in raising the hydrogen overvoltage. Inhibitors may be considered to act by forming some sort of a film over the bare cathodic steel and this film acts to prevent the ready evolution of hydrogen.

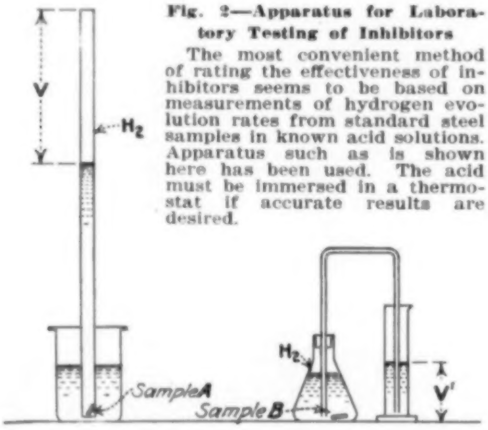


Fig. 2—Apparatus for Laboratory Testing of Inhibitors

The most convenient method of rating the effectiveness of inhibitors seems to be based on measurements of hydrogen evolution rates from standard steel samples in known acid solutions. Apparatus such as is shown here has been used. The acid must be immersed in a thermostat if accurate results are desired.

Commercially Available Inhibitors.—The manifest advantages of inhibitors have led to the commercial introduction of a number of proprietary compounds for this purpose, some of which are quite effective, although, as is common with many proprietary articles, the increased sales expense results in high prices. Among the large number of these proprietary compounds may be mentioned: (a) An acid extract of coal tar, high in nitrogen basis, (b) an inhibitor prepared from slaughter-house waste, by sulphonation, (c) a sludge from coal-tar treatment. Mouldy flour or bran have been used to a large extent in certain mills. These materials are poor inhibitors but probably pay for their trifling cost Size or glue has been used in England.

In view of the large number of organic substances which have been shown to have inhibitory properties almost any organic waste might be considered as having a possible value for this purpose. One group of such substances which are proving interesting may be men-

Table II—Acid Consumption Using Pickling Inhibitors

Test No.		Number of Batches	Weight of Pipe Pickled	Inhibitor	Average Temp. Deg. F.	Average Per Cent H_2SO_4	Average Time to Pickle (Min.)	Notes	Average Lb. Acid per Ton of Steel
1	Plant	15	210 tons	None	182	5.0	65	....	90.0
2	Laboratory	1	0.65 pound	None	175	3.0	53	24 Bé $FeSO_4$	82.4
3	Laboratory	1	0.65 pound	None	170	2.9	36	....	69.2
4	Laboratory	1	0.65 pound	Acid sludge	170	3.0	62	24°Bé $FeSO_4$	48.0
5	Laboratory	2	1.30 pound	None	175	3.0	22	....	44.0
6	Plant	11	147 tons	Bran	170	3.0	73	....	36.7
7	Plant	19	240 tons	Bran	160	3.5	124	....	35.4
8	Plant	13	154 tons	None	140	4.0	75	....	33.5
9	Plant	11	148 tons	Nitrogen Basis	170	2.9	90	....	23.9
10	Plant	21	264 tons	Acid sludge	160	5.0	111	....	23.4
11	Laboratory	2	1.3 pounds	Acid sludge	175	3.0	35	....	19.0

NOTE:—The above runs are not strictly comparable. For example no account has been taken of variations in weight of scale.

tioned. This group is the acid sludges which are formed during the sulphuric-acid wash of petroleum and coal tar hydrocarbons. These substances, which are practically waste products, being frequently used only as low-grade fuel, are in some cases more effective than the high-priced proprietary inhibitors.

Plant tests of certain of these sludges will be found in Table II. These materials are not at present on the market since the demand has not been sufficient to warrant the sales expense involved.

Acid Saving in Pickling Operation.—The principal use of inhibitors has been in acid baths for the removal of scale from steel articles. As is well known, before steel sheets or tubes can be galvanized they must be freed of the scale formed in rolling. For this purpose they may be immersed in a tank of hot dilute sulphuric acid. If no inhibitor is used in this operation much of the acid is consumed in dissolving the bare portions of the metal. This results in a waste of metal and acid and leaves the metal surface dirty and roughened. By the use of an inhibitor the action may be confined almost entirely to the dissolving of the scale. How successfully

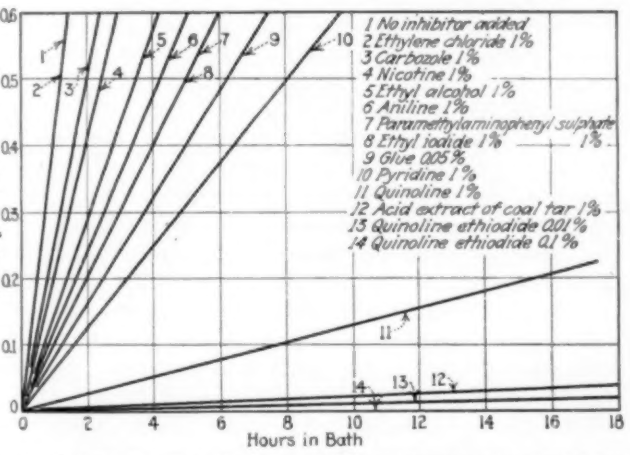


Fig. 4—Effectiveness of Various Inhibitors Measured by Hydrogen Evolution from Steel in 34 per cent Sulphuric Acid at 25 deg. C.

this may be done is illustrated in the laboratory data of Table I. In experiment 1 it will be noted that thirty times as much metal and acid was wasted in the absence of an inhibitor as in its presence. In experiment 2 conducted at a higher temperature and with a different inhibitor there was eight times as much wasted without an inhibitor as with one. However the actual acid and metal saving due to the use of the inhibitor was much greater in the second experiment, being 265 per cent as against 20 per cent in the first experiment. Some such general relation between acid waste and temperature exist in all cases but probably increases much less rapidly than would be indicated by comparing these two experiments.

Plant Tests of Inhibitors.—Plant and laboratory tests* to determine the acid consumption in pipe pickling both with and without inhibitors have been conducted and the results from a few of these are given in Table II. This table shows that large differences in acid consumption may occur in plant operation whether inhibitors are used or not, indicating the advantages to be gained by careful practice. The results indicate that savings in acid may result from the use of inhibitors. In these figures, however, no account is taken of other factors in the use of inhibitors which are in many cases more important than acid saving. Among these may be mentioned preservation of metal surface which is important in sheet works, avoidence of "hydrogen embrittlement" of wire, and the reduction of acid fumes and vapor carried into the air by escaping hydrogen. An inhibitor bath is also an insurance against the spoiling of metal by a careless pickler. All of these factors should be taken into account in considering the practical use of inhibitors.

*Made in co-operation with H. B. Lynch, Superintendent of Galvanizing Department, National Tube Co.

Removing Rust from System with Piping Acid

Editor's Note: *The following are extracts from a paper by F. N. Speller, E. L. Chappell and R. P. Russell (assistant director, Laboratory of Applied Chemistry, Massachusetts Institute of Technology) which was presented before the American Institute of Chemical Engineers at its Cleveland meeting. It describes the initial application of a new method of removing rust and other substances from pipe systems; namely the removal of the rust from the cold water piping of a large New York office building where the water supply capacity of the system had been seriously diminished by rust accumulations. The method is thought to be equally applicable to the removal of rust from condensers, boilers, heaters, and other fabricated systems which would be very expensive to take down and clean by ordinary methods. The removal has been accomplished by dissolving the rust in acid rendered inert toward the metal by inhibitors.*

William Brush, chief engineer of the New York Water Supply Board, has estimated that corrosion of the public water supply lines alone costs the New York taxpayer $5,000,000 per year. The cost of corrosion of building piping is several times as large. There are evidently two phases of this corrosion problem to be considered: first the retardation of further corrosion and second the removal of the corrosion products which have accumulated. The latter phase is particularly important in cases where the piping is practically uninjured mechanically and hence would be restored to usefulness were the rust removed.

The problem of a typical building may be illustrated by the case of the building which was the immediate occasion of the development of this cleaning method. This is a 35-story office building, located in downtown New York and occupied by tenants of the highest class. It was completed in 1912. In the last few years several of the lines in the offices became stopped and new exposed lines were run to replace them. A number of the half-inch lines feeding urinal boxes in the washrooms were running so slowly as to require too long a time to fill. In such a building service to the tenants must be kept at a high standard so that such a diminished water flow should be corrected at once. However replacement would be enormously expensive since much of the piping is concealed behind marble walls or in plastered columns. To run exposed piping is not desirable because of the appearance. Repiping would therefore have required the services of plumbers, carpenters, plasterers, bricklayers, marble setters, and painters, etc. The total cost was never formally estimated but experienced men estimate it as between $100,000 and $300,000. In addition there is the serious item of inconvenience to tenants.

Examination showed the piping to be physically sound and in view of the conditions the logical thing to do was to remove the rust directly from the piping without

disturbing the latter. A practical means of doing this was found in a strong acid solvent which dissolved the rust without injuring the pipe.

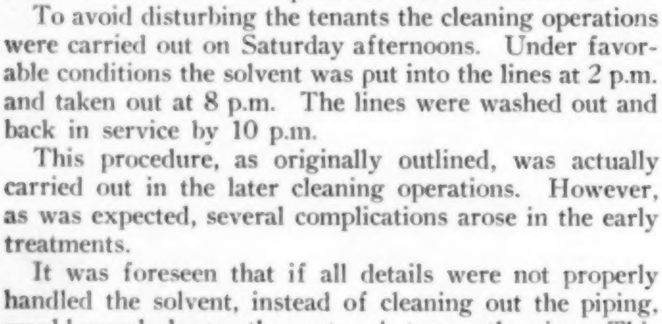
THE general plan of the cleaning operation was to cut off the section of piping to be cleaned, drain out the water, and fill the piping with the rust solvent, running it in by gravity from a special connection. The building described is divided into sections of 6 to 8 floors, each fed from a gravity tank. These sections were chosen as units for the cleaning. The rust solvent was mixed in two barrels, one or two floors above the gravity tank, and alternately fed from these down through a rubber hose. The rust solvent had been so chosen as to completely dissolve the rust in from 5 to 6 hr. However, as the solvent in the pipe was used up in dissolving the rust it was necessary to replace it by fresh material This was effected by a crew of men who drew off definite volumes of solvent from each outlet at assigned intervals. Each man was given instructions as to the floors, outlets, times and quantities before the operation was begun. Building porters were used for this work. At the end of the 6-hr. period when all the rust was dissolved the barrels were filled with clean water and allowed to wash down the hose and connections. The supply tank valve was then opened and the entire system thoroughly washed with water, each faucet, flushometer, slop sink, etc., being given a careful test to make sure that all solvent or rust particles were washed out.

To avoid disturbing the tenants the cleaning operations were carried out on Saturday afternoons. Under favorable conditions the solvent was put into the lines at 2 p.m. and taken out at 8 p.m. The lines were washed out and back in service by 10 p.m.

This procedure, as originally outlined, was actually carried out in the later cleaning operations. However, as was expected, several complications arose in the early treatments.

It was foreseen that if all details were not properly handled the solvent, instead of cleaning out the piping, would merely loosen the rust and stop up the pipe. This in fact occurred in several of the early treatments. However, experience showed that if the details of solvent renewal, etc., were properly watched no stoppages occurred. There was practically no trouble from this source in the later treatments. A definite technic of applying pressure to the outlet end of the line was developed which rapidly opened any temporary stoppages which occurred.

Many details required close attention. For example all basins were covered with cardboard to prevent spattering of solvent on carpets and walls. Particular attention had to be paid to protecting marble since the solvent



Cross-Sections of Pipe from Bankers Trust Building Showing Results Obtained by Rust-Removal Process

rapidly dissolves this material. Certain types of toilet bowls were specially flushed to avoid solution of the seating joints. Certain types of fiber washers are attacked by the solvent. These and other details were comparatively easy to handle after their existence was shown by experience. They, however, all combine to make the operation one requiring experienced supervision for its successful working.

The first section of the Bankers Trust Company building was treated on August seventh, and the building was completed about three months later, actual work being carried out over seven week-ends.

At the end of the treatment the building piping was all clean. Many outlets which had given only a small flow for years were restored to their original usefulness. No leaks have since developed and in general the treatment may be said to have been entirely successful in this commercial application.

The Rust Solvent. The rust solvent was a strong hot solution of hydrochloric acid (prepared by mixing commercial acid with hot water) to which an inhibitor was added to protect the steel. It is sufficient to say that these materials were originally of interest for use in pickling baths for metals and have been the subject of considerable interest in late years. The acid solvent used in the cleaning operation has been tested for as much as 64 hr., on steel piping at the end of which time no appreciable attack was found to have occurred. It has been found that the rate of attack of the solvent is about ten times as great on wrought iron as on steel and about twenty times as great on malleable iron as on steel but even on these two less resistant materials the rate of attack is not great enough to cause injury.

The composition and temperature of the rust solvent were chosen after making a laboratory study of the factors involved. This choice was influenced by consideration of the cost of material, cost of labor and of the fact that the operation had to be workable in actual commercial practice.

It may be emphasized that the action is one of true solution of the rust, the iron being dissolved as ferrous and ferric chloride. Where only loosening occurs stoppage is probable. Hence it is necessary to maintain a nice balance between all conditions to ensure the smooth working of the process.

Leaks—Before the cleaning of this building was undertaken it was realized that if at any point the piping or fittings had rusted through and the hole plugged up with rust that the rust solvent would start a leak. However in the many thousand feet of piping treated only five or six cases of this kind occurred, and these all in nipple threads against brass valves. These were replaced.

It is believed that this type of operation, modified perhaps to meet individual conditions, will be of great usefulness. A modification for the removal of carbonate scale has already been worked out. The details of the operation are being studied to effect economies in material and labor. As a matter of protection patents have been applied for upon the operation.

In presenting this paper the authors asked that acknowledgement be made of the co-operation and assistance of B. W. Evans, manager of real estate, and P. J. Dugan, chief engineer, of the Bankers Trust Company.

Colloid Symposium Stresses Industrial Subjects

APPROXIMATELY two hundred and fifty members and guests registered for the fifth national symposium of the Colloid Division of the American Chemical Society, which was held at the University of Michigan, Ann Arbor, on June 22, 23 and 24. The guest of honor on this occasion was Professor H. R. Kruyt of the University of Utrecht, Holland, who contributed a scholarly paper entitled "Unity in the Theory of Colloids." He showed that the customary division of colloids into two main types, viz., suspensoids, or lyphobic colloids, and the emulsoids, or lyophilic colloids, is not warranted by any marked differences in properties. Accordingly it is not necessary that they be treated from different points of view. The electrical phenomena are influenced by the valence and adsorbability of the ions present and Professor Kruyt declared that the importance of the hydrogen ion has been overemphasized since it acts only as an ion. The iso-electric point is varied by all ions present, including the hydrogen ion.

OF THE twenty-four papers presented before the symposium, a number were of industrial interest. In discussing adsorption from solution by adsorbent charcoals, E. J. Miller showed that unless the charcoal used for the adsorption experiments is ash-free, divergent results are obtained. Using an ash-free sugar charcoal, it was shown that inorganic acids are adsorbed, whereas inorganic bases are not. The acid adsorbed in a salt solution is exactly equivalent to the base set free, and so the adsorption is hydrolytic. The adsorbed acid appears to be undissociated, since it is unable to invert cane sugar.

The influence of a second liquid on the formation of soap gels was discussed by Professor Harry N. Holmes and R. N. Maxson. The striking influence of the addition of a second liquid to soap gels on the liquid holding power of the soap was shown by several examples. Thus anhydrous turpentine is nearly powerless to form a gel with anhydrous soap, while the addition of 0.04 cc. water to 0.05 gm. dry sodium stearate allows the preparation of an emulsion containing 35.5 cc. of turpentine.

James Craik pointed out that the number of chemically individual cellulose nitrates which have been postulated to explain the solubility and chemistry of the continuous series of nitrates is unnecessarily large. Only three are required, one of low nitrogen content, one of high nitrogen content and one of intermediate nitrogen content. Intermediate nitrocelluloses are mixtures, and their solubility is influenced by the distribution of the components as well as their relative amounts.

APPLICATION of colloid chemistry to the electrodeposition of metals was reviewed by Dr. William Blum of the Bureau of Standards. He pointed out that addition agents to plating baths are often colloids. Addition agents added in correct amounts have the following effects: the structure of the deposit is improved, a small amount of the agent goes into the deposit, and the throwing power is increased. The throwing power depends on three and only three factors; the cathode polarization; the conductivity; and the cathode efficiency. The colloid added as an addition agent usually increases cathode polarization, does not affect the conductivity with the amounts used; and either increases or decreases the cathode efficiency. There is a colloid migration in the bath which may or may not reach the actual cathode surface. There is no general theory of the behavior of colloids in plating solutions.

In a paper on the relation of colloidal ferric hydroxide to the bond in molding sands by Professor G. G. Brown and C. C. DeWitt, it was demonstrated analytically and synthetically that a satisfactory molding sand contains three essential constituents: the sand itself, a kaolin bond; and a ferric hydrosol adsorbed on the surface of the sand. The synthetic molding sands prepared from pure silica, pure kaolin and an artificially prepared hydrosol duplicated high-grade natural molding sand very closely with regard to strength and permeability.

Colloid properties of hydrated portland cement were discussed by Professor A. H. White. Long time tests on neat portland cement bars involving alternate wettings and dryings show that there is a progressive net expansion under such conditions. This expansion is the main cause of disintegration of concrete structures that are exposed to damp climates. The behavior is explained on the basis of the progressive reaction over long periods of time of the particles of undecomposed cement and water as influenced by alternate wetting and drying.

It has often been considered that chemical compounds are formed in color lakes between the mordant and the dye. Harry B. Weiser and E. R. Porter in a paper on the physical chemistry of color lake formation showed that there is no basis for the supposition that these compounds are formed, but that the phenomena are those of adsorption and are influenced by the hydrogen-ion concentration and the concentration and specific effect of the salts present.

Plasticity symposium. In introducing the plasticity discussion, Professor E. C. Bingham declared that there are at least four types of substances as shown by their viscous flow properties. If the rate of flow is plotted against the shearing force, the first type gives a straight line passing through the origin; the second type gives an initial curvature and then a straight line that does not pass through the origin; the third gives a curved line passing through the origin and the fourth type is represented by the metals where the deformation is due to slip planes.

S. E. Sheppard and E. K. Carver reviewed the various theories accounting for the solubility of cellulose esters in pure and mixed solvents. With the aid of plasticity measurements it is concluded that the best explanation of these phenomena lies in the polar or nonpolar character of the solvents. The influence of one solvent on the polarity of the other explains the solubility relationship in mixed solvents and minima in the plasticity curves.

Paul M. Giesey and S. H. Arzoomanian described a simple and cheap, but effective and rapid type of plastometer suitable for control work. As a result of experiments with the falling ball viscosimeter on cellulose-ester solution H. E. Phipps showed that by using spheres of different density and plotting the velocity of fall against the density difference of the ball and the solution, the type of flow could be shown. Ludenburg's correction was applied to obtain these results. When the results of the falling ball method are corrected by Ludenburg's correction the method is satisfactory for commercial and control work on nitrocellulose solution according to a second paper presented by J. K. Speicher and G. H. Pfeiffer.

Natural Resources and Manufactures of WESTERN PENNSYLVANIA

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and

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WESTERN Pennsylvania has been called the Region of Vulcan. With its great variety and wealth of fuel it is indeed the power-house of the nation. Industrially it is a land of fire, a vast Hephæstian smithy. With its heavy manufactures it makes an amount of products that is almost inconceivable. The total railroad tonnage of the Pittsburgh district alone is more than 173,000,000 tons a year, and the river tonnage is about one-sixth as much.

In the following account of the natural resources and manufactures of this region, we will first describe the prominent technologic developments in the Pittsburgh district, and then present a tabular résumé of the industries of all the Western Pennsylvanian counties.

Natural Resources of the District

AS THE Pittsburgh district[1] began its activities leading to its present high degree of industrial development, the natural resources which it commanded economically became active material agents and have continued to constitute the very backbone of the present structure of Western Pennsylvania. Increasing demands were brought about by ingenuities of an enlarging number of progressive people, so that the aggregate of potential demands magnified actual uses of the exhaustible resources. Slowly, as the worth of this group became apparent, the different elements became, more and more, lawful properties of individual operators. Their uses were soon recognized and applied in industry, and, in consequence, the opportunities for processing which they offered were capitalized. There has resulted in Pittsburgh the great "Golden Triangle," representative of the wealth which the natural resources have created through the industrial life of the district; a city known for its industrial pursuits throughout the civilized world, and one whose resources continue to add to the strength of its present position.

Coal. The Pittsburgh industrial district[2] is underlaid throughout its entirety with bituminous coal, and is the most important coal area in the United States in the variety, quality, and extent of the deposits. Bituminous coal of practically every grade used commercially is found in the Pittsburgh district. The Pittsburgh seam coal is the most volatile of all these grades, ranging from 33 to 41 per cent in volatile combustible matter, and is universally known for its uses. About half the coal mined in Pennsylvania is taken from this seam, and this amount approximates one-sixth of the coal mined in the United States. The important veins of bituminous coal occurring in the Pittsburgh district are Lower, Twin and Upper Freeports, Lower, Middle and Upper Kittannings, Pittsburgh and Pittsburgh Big Vein, Sewickley, and Piedmont. These varieties of coal are used for the making of coke, in cement burning, for domestic purposes, for making illuminating gas, for steam purposes, for making producer gas, and for tile and pottery burning.

The industrial district normally mines more than 50,000,000 tons of coal annually, and this work alone gives employment to more than 50,000 persons. The production of coal is one of Pittsburgh's major industries. Coal has, in fact, been largely responsible for the great industrial development of the district. With such immense deposits of this natural resource available, Pittsburgh industries are well fortified for years to come in the assurance of a supply of this most essential fuel.

Discoveries and inventions will undoubtedly create many new uses for coal and the derivatives which it can yield will tend to replace other fuels which are nearing points of exhaustion. These inventions may be expected to keep pace with the needs of industries; and before any fear can be felt for the exhaustion of coal, more

[1]The so-called *Pittsburgh district* embraces the area that is located within one hundred miles of the city of Pittsburgh.

[2]The *Pittsburgh industrial district* lies within a thirty-mile radius of the city of Pittsburgh.

efficient combustion uses will be made of that yet remaining to insure the further safeguarding of Pittsburgh's fuel supply.

Coke. The production of coke is one of the leading manufactures of the Pittsburgh district, which is the center of the coke industry of the United States. Coals of the district have natural coking qualities and the coke made from them is almost perfect for metallurgical purposes. This coke, by solving the fuel problem of the blast-furnaces, fostered the large-scale production of iron and steel in Pittsburgh.

The Connellsville region of the district was the experimental ground for the making of coke, and since the coking of coal has been carried on commercially this region has retained the leadership in this industry. Beehive ovens, used there, produce such desirable fuel for reducing iron ore that scarcely, if any, changes have been made in the type of the ovens for this purpose. The byproduct coke oven has since been introduced and is now the principal process by which metallurgical coke is made. At the same time, the basic materials for making various chemicals, dyes, explosives, fertilizers, and other commodities are recovered as byproducts.

The Pittsburgh district burns approximately 70 per cent of the beehive coke produced in the United States. The value of the production here normally is about $100,000,000 annually and this product is supplied by 40,000 ovens, which yield about 17,000,000 tons each year.

The beehive oven, however, is no longer the only commercial method of coking coal. The introduction of other methods has been found necessary, due to the increase in the production of steel products and the gaseous fuel requirements. Coke is now but one of the products of coal carbonization. Byproduct plants are located at sixteen places in the district and produce 11,500,000 tons of coke annually. This is about one-third of the country's production, and with the byproducts totalling about 175 billion cubic feet of gas, 134 million gallons of tar, 25 million gallons of motor fuels, and 175 thousand tons of ammonium sulphate, are valued at more than $100,000,000.

The total value of the products of the Pittsburgh district's coke ovens is more than $200,000,000 annually. Employment is given to 9,000 men, and the enlargement of plants under way at the present time, costing over $25,000,000, will materially increase the production of the industry in dollars as well as in man-power employed. Coke is allied with steel, and in both of these industries the Pittsburgh district is the leader. There is a constant demand for coke by its ally, and the maintenance and growth of the coke industry are steadily advancing with the basic manufactures in keeping abreast with the needs of an enlarging industrial nation. The demands for byproducts are constantly increasing as advancements in other industries are creating a need for them.

Natural Gas. The Pittsburgh district produces natural gas at the rate of 44 billion cubic feet annually. The production has been developed in twenty-three and is used in twenty-six counties of the state. More than 128 billion cubic feet are consumed annually in the Pittsburgh district alone. The excess amount used over that produced in the district is brought in from West Virginia and Kentucky.

The district produces about 4.4 per cent of the nation's natural gas supply from 18,000 wells in an area of five million acres of gas land. In recent years there has been a marked decrease in the rock pressure of the natural gas wells and in the number of producing wells per domestic consumer. There are now more than 400,000 domestic and commercial consumers in the Pittsburgh district using this resource for heating and lighting purposes. Owing to its increasing scarcity, natural gas is rapidly going to a much smaller available volume basis. Recently the natural gas pressure has been reduced to about 2 ounces, that of the manufactured gas basis. It is claimed that the amount of natural gas wasted, due to inefficient burning, is equal to the amount of gas actually used effectively, and that the money value of this waste exceeds $3,000,000 each day. Eighty per cent of the gas received by domestic consumers is wasted. The efficiency of domestic burning appliances is comparatively low and almost three feet of gas is consumed to do the work which one can do.

Natural gas is used in many industries and especially adapts itself as fuel for use in the glass industry. Local public utilities are extending their operations in adjacent gas fields to continue the supply of natural gas to the district. Educational programs are being carried out in order that consumers may learn the most economical means of burning this exhaustible resource.

The conservation of the supply of natural gas yet remaining is a serious problem and is being given due consideration at this time. It is expected, however, that the supply is sufficient at the present rate of usage to meet demands for a number of years to come. Meanwhile more efficient use of the waning supply will no doubt be effected to make its availability extend over a longer period than is generally supposed. It is clear that the natural gas supply of the Pittsburgh district is of serious concern and its present state of approaching exhaustion must be reckoned with.

Petroleum. A report to the American Petroleum Institute has made known that there are estimated to be 380,000 acres of oil-producing land in Pennsylvania, 11,000 of which are proved but undeveloped, and, in addition, nearly 11,000,000 acres which may contain oil. There are estimated to be over 5,000,000 barrels of oil in the proved area, besides existing wells, and this oil may later be made available. The oil field of the Pittsburgh district produces crude petroleum (paraffine-base) valued at $5,000,000 annually. The yield from the 4,300 wells in this district is at a much slower rate than that of the midcontinent and western fields, but the average life of the wells is much longer. Some of the district's wells have been producing oil for over twenty-five years at the rate of eight barrels per day with only a gradual decrease in yield. Larger wells are being pumped at the rate of two hundred barrels a day and more. A higher price is commanded for Pennsylvania crude than is paid for oil from any other field.

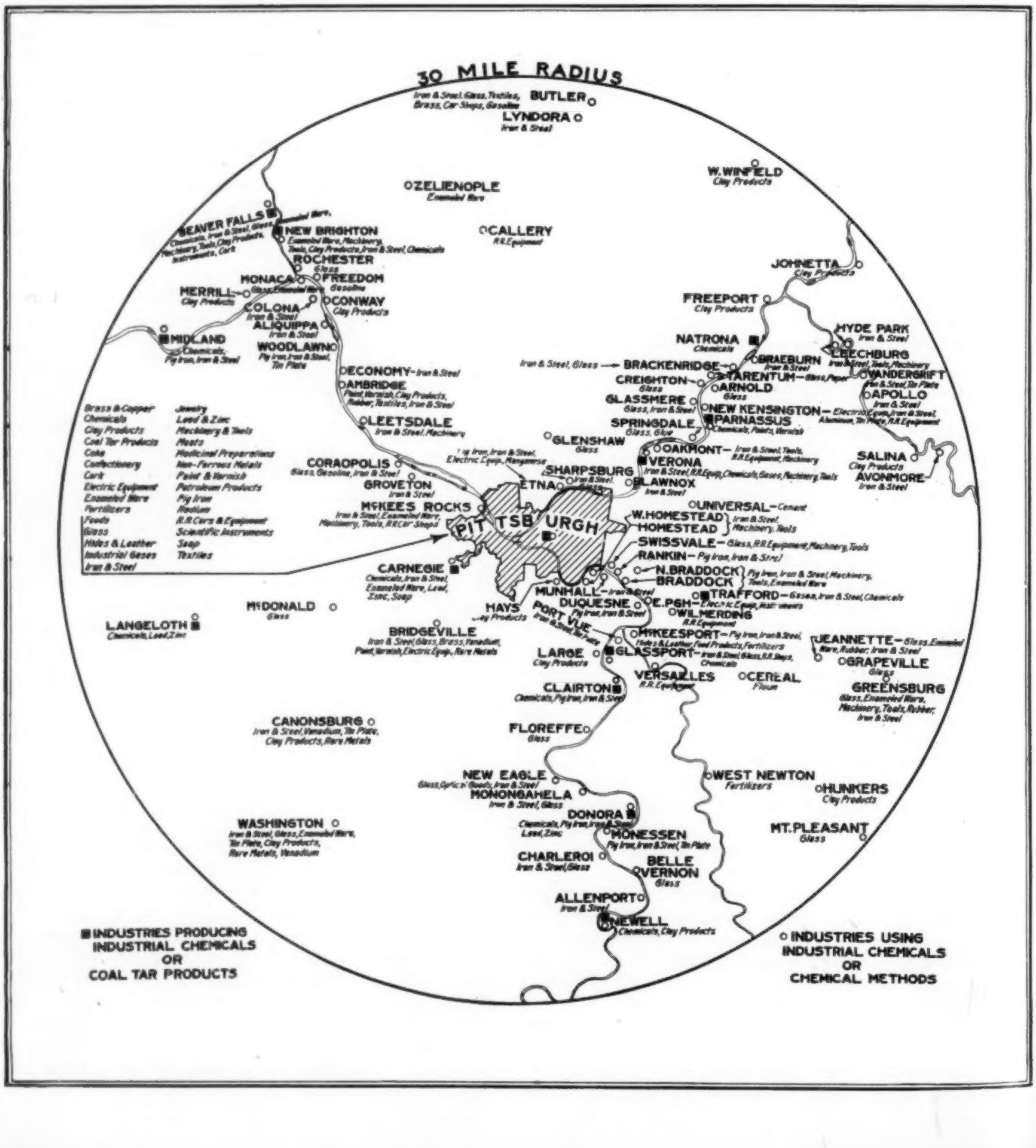
The commercial refining of petroleum was started in Pittsburgh and it has since remained a major industry of the vicinity. The 11 refineries have a combined capacity of 16,000 barrels per day. Allegheny County leads in the number of refineries with eight, followed by Beaver with two, and Washington with one. The refinery products from these plants are valued at $25,000,000 annually, or 15 per cent of the state's output. More than 75,000,000 gallons of gasoline and 20,000,000 gallons of kerosene are included in the output. Much of the crude oil is brought to the local refineries from fields outside the state.

Regardless of the relatively small production of crude oil in Western Pennsylvania, petroleum interests in the Pittsburgh district are increasing and now there is centered in it nearly one-seventh of the refinery production of the world.

Power. The natural resources of coal, gas, and water in the Pittsburgh district have made possible the expansion of power facilities. The accessibility of coal throughout this territory has made the generation of power relatively economical even in isolated plants. Natural gas, too, is near at hand. The water supply afforded by the rivers, combined with the fuel resources, offers ideal conditions for power generation. The natural resources of the district for this use, again, have promoted Pittsburgh's industrial development.

The demand for power is more than met by the facilities offered, and, in fact, the power plants in the district which are operated by central-station companies have been so expanded that only two cities in the country exceed their total generating capacity. The requirements of more than one and one-half million horsepower to drive the industrial machinery of the manufacturing concerns are supplied in excess by the local power companies. The network of power lines having been extended to meet the demands of the industries has also brought electric light service to the very doors of the outgrowing city. The use of electrical energy for light and power has now become so general that a continuous expansion program is being carried on by the power companies in anticipation of future demands which will be brought about by the ever-increasing social and industrial development of the district.

Thirty-three per cent of Pensylvania's installed horse-



power is produced in the Pittsburgh district, in itself only 6.3 per cent of the state's area. Only the states of Illinois, Massachusetts, New York, and Ohio have more installed industrial horsepower than the Pittsburgh district. The plants of the district average almost two and one-half times more power installations than the state, an average of six horsepower for each workman employed in the industry. As with coal, the quantity of electric power is in excess of the needs of the Pittsburgh district. The continuance of the supply at a cost comparable with that of any other industrial center is an asset of immense value, appreciated by the consumers, who are taking advantage of this resource which their location and facilities are affording them.

Limestone. Deposits of limestone are spread throughout the Pittsburgh district. All of Washington County is abundantly supplied with this mineral, which is interbedded with shales, and in some places there are equal proportions of limestone and shale. But the limestones of Washington County, although abundant and varied, are mostly of inferior grades and do not compare favorably with the products of other portions of the state. Nevertheless their capacity permits them to be extensively used throughout the county for highway construction and for making of lime. The best exposures are found in the vicinity of Washington, all of which are suitable for agricultural lime and road metal.

Fayette and Westmoreland Counties contain many limestones which are fairly well distributed. The strata in the most part are impure and interbedded with shaley materials, so that they do not form the basis for any extensive quarrying industry. They are mined locally in many places, however, for the manufacture of agricultural lime and for road metal.

A number of limestone members occur in Allegheny and Beaver Counties, but most of them are of little value and of limited areas. A large supply of stone has been quarried, though, and utilized for various purposes. Although containing few beds, the strata of the most valuable grade of limestone in Western Pennsylvania are found in Armstrong and Butler Counties. Much of this limestones is quarried and used in the manufacture of portland cement, lime, fluxing stone, sintering stone, and in road building. The deposits in Butler County are being worked extensively and those in Armstrong County will become of greater importance as transportation facilities are improved.

A summary of the limestone industry in the Pittsburgh district shows that the crushed limestone demanded for concrete, road metal and railroad ballast has been steadily increasing, but the quarries in the district have more than supplied the local need. The production is consumed locally in the most part. Pulverized limestone for fertilizing purposes and for filter use has not been produced to any great extent in the past, but the demand is increasing and the supply is available for these applications. The fluxing limestones used within the district are supplied mostly by adjacent counties. These reserves are adequate to supply the demand indefinitely. The limestone used in cement making in the Pittsburgh district is now being produced in part by underground mining methods, and with the continuance of this practice the supply of portland cement materials will be adequate for economic production for many years. Agricultural limestone is, and should continue to be, produced widely throughout the district for local consumption. Manufacturers requiring limestone in making glass, ceramic articles, paint, and allied products have been able to supply their demands from the limestone sections of the district and its adjacent counties.

Cement Materials. In the Pittsburgh district four portland cement plants are in operation: two in Allegheny County, at Bessemer and Universal; and two in Lawrence County, at New Castle and Wampum. The plant at Universal utilizes a mixture of blast-furnace slag and limestone, while the others use a mixture of limestone and shale. Slag is in abundance in the district, and suitable limestone and shale are found in considerable quantities in Western Pennsylvania.

The portland cement plants in the eastern part of the state produce more economically than those in the Pittsburgh district, but the freight rate factor sponsors the operations in Western Pennsylvania, and they should be continued for an indefinite period. The cement materials resources of the Pittsburgh district provide an economic means of utilizing a part of the immense qualities of slag resulting from steel mill operations. More complete knowledge of cement with consequent increases in uses will probably enlarge the industry in this district. Even the present-day demand for cement may result in the more extensive use of blast-furnace slag in this production. The composition of slag is especially applicable in this manufacture and may be used at the source where the limestone for mixing is most accessible. The output of cement by the plants already established, however, is sufficient to meet the present demand.

Glass and Building Sands. The proximity of glass-sand deposits, the natural resources of coal and natural gas, and the advantageous location as a distributing center have made the Pittsburgh district the leader in the glass industry of the country. Glass manufacture ranks third among Pittsburgh's manufacturing industries.

At present the glass-sand industry is seated in the central and western parts of Pennsylvania. The central region is by far the more important, both with respect to quality and quantity of glass sand produced; its production area is confined to several localities. The workable deposits in the western part are distributed over a considerable area, and glass-sand quarries are being operated in Elk, Fayette, Jefferson, Venango, Warren and Westmoreland Counties.

The Pottsville formation of glass sand in the southern part of Venango County has a thickness of 120 to 130 feet. Sand plants are operated near Kennerdell in this deposit. At Dunbar, Fayette County, glass and railroad sand are prepared. The former is used for making skylights, wire plate glass, window and similar grades of glass. South of South Connellsville sand is prepared for use as railroad sand, molding sand, plasterers' sand, building sand, and glass sand. In Westmoreland County, near Curry, sand is produced for making window glass and for grinding plate glass. About halfway between Derry and Millwood, sand suitable for the manufacture of window glass is available. Building and grinding sands are prepared at the Millwood quarry. Near Seward sand is available for use in the manufacture of window glass and glass bottles.

Sands, relatively free from other constituents than silica, are used in the manufacture of glass. Such deposits, however, are of rare occurrence. In fact, pure quartz sands are not found in nature. The kind of glass to be made, then, determines the amounts of impurities that are permissible in the sand which is used.

Building sands find ready markets in the populated centers. Grinding sand is used for abrasive purposes in many industries. Molding and plasterers' sands are in demand, and the output of the present quarries is readily consumed. The sand industry, although not extensive in comparison with the basic industries affecting natural resources in the Pittsburgh district, is a valued asset in carrying out operations in which its products are applicable.

Alluvial Gravel and Sands. In connection with the detailed geological survey of several quadrangles in Western Pennsylvania in 1908 and 1909, a careful study was made of the alluvial gravel and sands. The deposits treated here include Allegheny, Armstrong, and Beaver Counties. These gravel and sand deposits are found on terraces and in the river bottoms, and are of two distinct types, namely, glacial and non-glacial.

The present position of the deposits has been determined by geological processes. To illustrate: The sand of the Pittsburgh district is of two principal varieties: that of the Allegheny and Ohio Valleys is sharp and "hard," and that of the Monongahela Valley is round and "soft" grained. Much of the former comes direct from the igneous rocks of Canada, of which the quartz particles are entirely angular. The latter has been derived from the sedimentary rocks that outcrop in its drainage basin. Upstream the deposits of the Monongahela decrease in thickness and the materials, as a whole, are much finer. Only the basal portion of these deposits is as coarse as the glacial gravels of the Allegheny Valley.

THERE are many mineral resources of the Pittsburgh district which have not been utilized. They remain in store for the future or await the efforts of the present people to capitalize the potential values which accrue from their uses. It would appear to be a waste not to utilize the materials found here, instead of transporting others of a similar nature for use as they could be, provided their accessibility warrants economic recovery. Many might be processed at their present locations to fabricate demand commodities, and there are possibilities that articles not made here at all could be added to the diversification of the district's present industrial scope, through the use of those resources. The minerals that are available and produced in commercial quantities within a hundred miles of Pittsburgh are listed below:

EDITOR'S NOTE:—*In a subsequent issue the author's will discuss the chemical producing and consuming industries of the Pittsburgh district and of Western Pennsylvania.*

AMETHYST.—	Bedford County, reported at East Bedford.
BROWN IRON ORE.—	Armstrong County, formerly worked in West Franklin Township; also occurs in Beaver, Butler, Clarion, Center, Clearfield, Jefferson, Indiana, and Lawrence Counties.
CEMENT MATERIAL*.—	Quarries in Lawrence County, at New Castle and Wampum. Blast-furnace slag and limestone are used at Universal for portland cement. Clay dug at mines, Blair County, is used for white cement.
CLAY (BRICK)*.—	Produced extensively in Allegheny County and occurs in other countries in the district.
CLAY (FIRE)*.—	Mined in many places in connection with coal in Allegheny, Armstrong, Beaver, Bedford, Cambria, Clarion, Center, Clearfield, Clinton, Elk, Fayette, Huntingdon, Indiana, Jefferson, Lawrence, McKean, Mercer, Somerset, and Westmoreland Counties.
CLAY (FLINT)*.—	Blair County; Cambria County, Johnstown District and Mineral Point; Center County, Moshannon Creek and Sandy Ridge; Clarion County, Rimersburg; Clearfield County, Anderson Creek, Bigler, Burly, Chase, Clearfield Creek, Curwensville, Faunce, Hogback Run, Stronack and Wallacetown; Indiana County, Deckers Point, Dilltown, Glen Campbell, Little Mahoning Creek, and South Side of Bear Run; Jefferson County, Frostburg.
CLAY (KAOLIN)*.—	Pits at Huntingdon County, Birmingham Township; Franklin County, Concord Township.
CLAY (POTTERY)*.—	Produced in Beaver County, at New Brighton and Vanport.
CLAY (SEWER PIPE)*.—	Produced in Beaver County, at Blockhouse Run. Also occurs in Allegheny County.
CLAY (TERRA COTTA)*.—	Near Pittsburgh.
COAL (BITUMINOUS)*.—	Coal-bearing rock covers practically the whole of the district, and is mined extensively in Allegheny, Armstrong, Blair, Butler, Beaver, Cambria, Cumberland, Greene, Indiana, Jefferson, Lawrence, Washington, and Westmoreland Counties; the greater portion of Clarion, Elk, Fayette, Mercer and Somerset Counties, parts of Bedford, Cameron, Center, Clinton, Crawford, Forest, Fulton, Huntingdon, McKean, and Venango Counties.
GALENA.—	Blair County, in Sinking Valley, accompanying zinc ores.
GANISTER*.—	Mined for silica brick in Bedford County, at Pattonville; Blair County, at McKee Gap and Point View. Huntingdon County, at Water Street Gap.
HEMATITE.—	Franklin County: small quantity in South Mountain, near Chambersburg.
LIMESTONE*.—	Extensively quarried over a large part of the district for building stone and flux.
MANGANESE ORE.—	In Blair, Center and Huntingdon Counties.
MINERAL PAINT.—	Cambria County, at Johnstown; Lawrence County, at Pulaski.
NATURAL GAS*.—	Large quantities in the district, chiefly in Butler, Fayette and Westmoreland Counties.
PETROLEUM*.—	Produced in large quantities in Allegheny, Armstrong, Beaver, Butler, and Washington Counties.
PYRITE*.—	The only commercial output of pyrite reported during the last few years is the small quantity obtained in connection with the mining of bituminous coal in Mercer County.
QUARTZ*.—	Franklin County: formerly mined near Fayetteville.
SAND AND GRAVEL*.—	Local deposits utilized in various parts of district.
SAND (GLASS)*.—	Dug in Fayette County, at Dunbar, and along Monongahela River, near Belle Vernon.
SAND (MOLDING)*.—	Produced in Allegheny, Beaver, Butler, Fayette and Westmoreland Counties.
SANDSTONE*.—	Quarried at many localities in the district.
SANDSTONE (BLUESTONE*.—	Quarried in Allegheny, Fayette, and Westmoreland Counties.
SHALE*.—	Lawrence County, mined at Pulaski; Westmoreland County, mined for pigment at Greenwald.
SIDERITE (IRON CARBONATE).—	Formerly mined in Bedford, Clearfield, Cambria, Fayette, Fulton, Huntingdon, and Somerset Counties.
SMITHSONITE (ZINC CARBONATE).—	Blair County, in Sinking Valley.
SPHALERITE (ZINC BLENDE.—	Blair County, in Sinking Valley, with galena and smithsonite.

*Mined in commercial quantities; others found in commercial quantities.

Mineral Resources Give OKLAHOMA

Promise for Future Chemical Industry

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and

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COMPREHENSIVE survey of the industrial situation shows that few states in the Union possess such large reserves of essential raw material suitable for the manufacture of a great variety of chemical products as does Oklahoma. And at the same time few states are today producing as little in the way of chemicals as this state.

It should be remembered, however, that Oklahoma got off to a late start. During the early and middle decades of the nineteenth century, while the states east of the Mississippi River, as well as those immediately surrounding Oklahoma, were laying the foundations of their material prosperity and developing their natural resources, Oklahoma lay dormant. At the time when plants for the manufacture of all sorts of useful commodities including chemicals were being established in the older states, Oklahoma was still undeveloped.

Of the states adjoining Oklahoma, Missouri came into the Union in 1821, Arkansas in 1836, Texas in 1845 and Kansas in 1861. But not until 1907, nearly half a century later than Kansas was admitted, did Oklahoma join the sisterhood of states.

With this brief background of history it is of interest to see what Oklahoma has accomplished during the past two decades. In this connection one should study the map in Fig. 1, which is intended to show the location of the mineral resources of the State, of the list of minerals in Table I that have already been developed, and the chart in Fig. 2, which shows the rate of development of mineral products during the present century, starting with $4,000,000 in 1901 and ending with $500,000,000 in 1925. During this time Oklahoma has advanced from thirty-fifth place to second place among the States in new wealth per year from minerals. Chief among the minerals that have contributed to Oklahoma's mineral wealth are the following:

Petroleum. Oklahoma has 300 separate and distinct oil and gas fields, already discovered. Over 2,000,000,000 barrels of crude oil, worth over $3,000,000,000 have been produced. One oil field, Seminole, which eighteen months ago was unknown, is now (during June, 1927) producing over 350,000 barrels of oil per day. And the end is not yet. No one knows where the next field will be found, or how much oil it will produce.

Natural Gas. Oklahoma produces each year 200,000,000 thousand cubic feet of gas, worth $30,000,000.

Asphalt. There are unnumbered millions, possibly billions of tons of asphalt occurring in southern Oklahoma, very little of which has been developed.

Zinc. One county in Oklahoma now produces more zinc each year than all other states combined. The yearly value of the zinc approximates $42,000,000.

Lead. Very large amounts of lead occur, much of which is associated with zinc in ore bodies.

Gypsum. The best estimates show 133,000,000,000 tons.

Salt. Enough salt water flowing from the ground, going to waste to make 100 car loads of salt a day, besides vast bodies of rock salt.

Limestone. Sufficient of this material in various parts of Oklahoma, widely distributed, to burn all the lime, and furnish all the crushed rock for America.

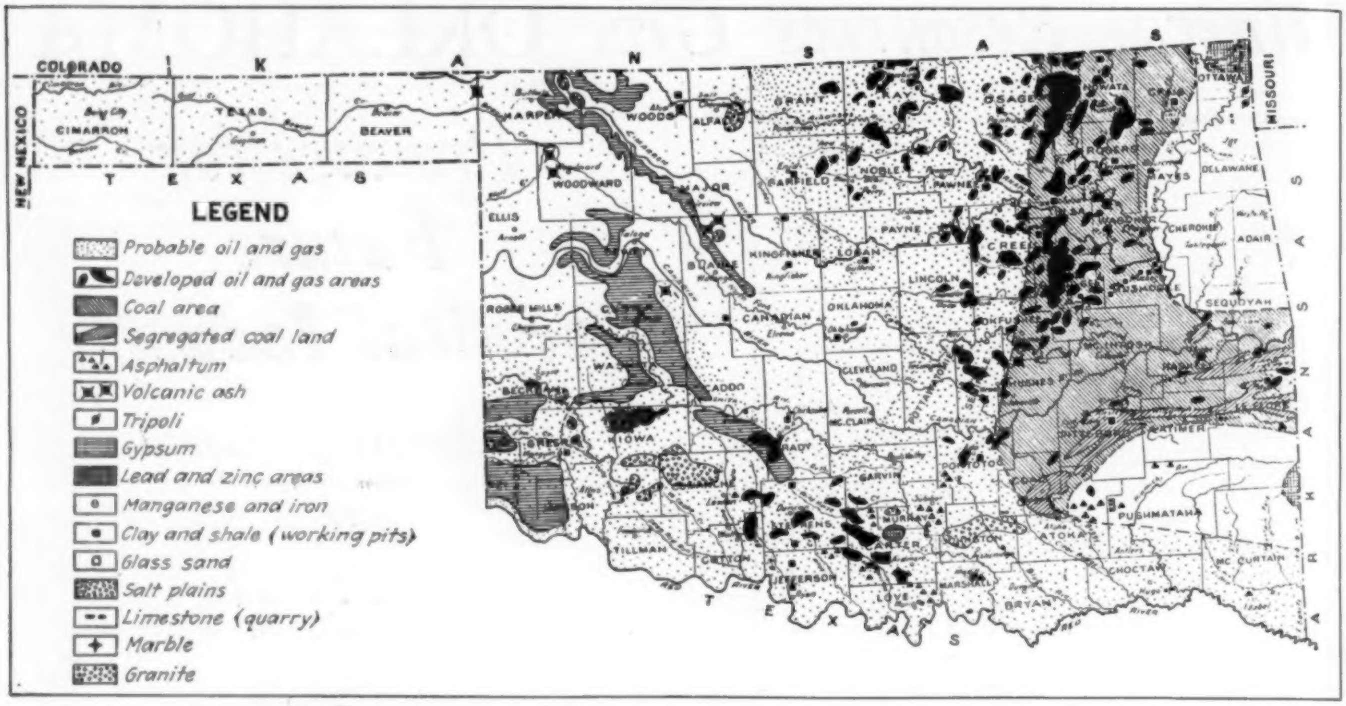
The mineral products which have been so briefly enumerated are those which must form the basis of the future chemical industry of Oklahoma. It will obviously be impossible in an article of this length to do little more than outline the possibilities of the subject. Nor have we data to anticipate the future demands along chemical lines. However, let us examine some of the known raw materials and note the chemical products manufactured therefrom.

First, take oil, for the reason that at the present time the refining of crude petroleum is by far the most important chemical industry, being carried forward in

Table I—Estimated Mineral Production of Oklahoma in 1925

Petroleum	176,760,000	bbls.	$347,000,000
Zinc	280,668	tons	42,662,000*
Natural Gas Gasoline	390,800,000	gal.	41,600,000
Natural Gas	215,000,000	M. cu. ft	32,000,000*
Lead	82,775	tons	14,271,000*
Coal	2,239,000	tons	8,384,000*
Cement	2,300,000	bbls.	3,500,000
Gypsum	342,000	s. tons	2,737,000*
Clay Products			2,000,000
Stone	1,340,000	s. tons	1,527,000
Sand and Gravel			1,000,000
Other Minerals			3,500,000
Total value			$500,181,000

*Estimated. Other statistics obtained from "Mineral Resources of the United States in 1925," Bureau of Mines.



Map of the Mineral Resources of Oklahoma Prepared by the Oklahoma Geological Survey

Oklahoma. There are in the state approximately 75 oil refineries, with a rated daily capacity of about 325,000 barrels of crude oil. More people are employed in this industry, and more money is invested in plants and equipment, than in any other chemical industry in the State.

No one today would have the temerity to venture a guess as to the possible number of petroleum derivatives, but the number will run into the thousandt. Estimates as high as 5,000 have been made. Several hundreds of these petroleum products are now on the market in the United States and the results obtained in the research laboratories of the country are constantly enlarging this number.

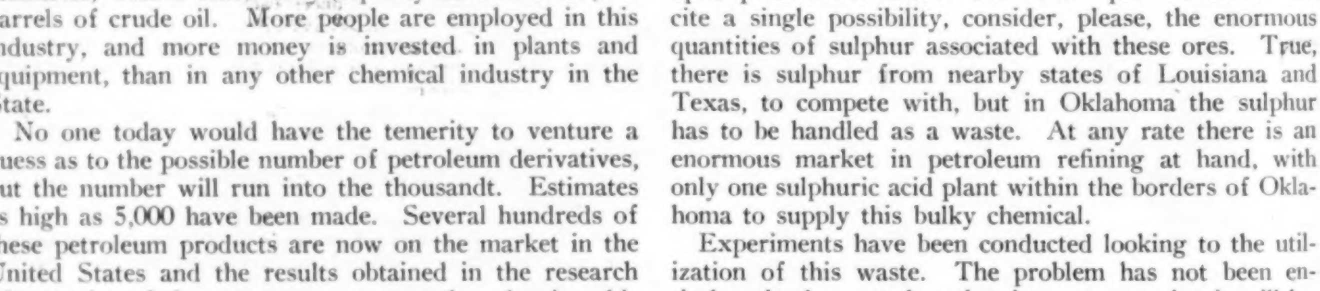
Refineries in the state of Oklahoma not only are turning out enormous quantities of gasoline, kerosene, and the usual petroleum products but chemists are actually producing alcohols and chemical derivatives from gases resulting from the cracking processes. This use of petroleum is barely out of the experimental stages yet it does not require a prophet to foresee the opportunity awaiting the chemical industries along this line alone.

In the case of lead and zinc products, Oklahoma produces about 280,000 tons of zinc per year, and about 80,000 tons of lead. These metals form the basis for pigments, alloys, medicines and countless other commercial necessities, already being manufactured. Their chief interest for the chemist, however, lies in their undeveloped possibilities rather than their present uses. To cite a single possibility, consider, please, the enormous quantities of sulphur associated with these ores. True, there is sulphur from nearby states of Louisiana and Texas, to compete with, but in Oklahoma the sulphur has to be handled as a waste. At any rate there is an enormous market in petroleum refining at hand, with only one sulphuric acid plant within the borders of Oklahoma to supply this bulky chemical.

Experiments have been conducted looking to the utilization of this waste. The problem has not been entirely solved as yet, but chemists are sanguine it will be. The estimated possible production of 100 per cent H_2SO_4 per year from this source in 60,000 tons.

The salines should also be noted. In western Oklahoma there are several regions of salt springs from which flow apparently inexhaustible amounts of a saturated solution of salt brine. From this brine there might be manufactured many useful products including the following: salt, calcium sulphate, hydrocholoric acid, chlorine, soda, lye, bleaching powders, calcium chloride and many others.

Other springs in eastern Oklahoma yield salt and sulphur water and closely analagous to these surface brines are those from deep wells in the oil fields. In all parts of the state, but particularly in the eastern coun-



Plant of the Ozark Chemical Co., Manufacturers of Sulphuric Acid, Sand Springs, Okla.

ties, there are thousands of deep wells which have been drilled in the search for oil, but which encountered only water. This is usually spoken of as "salt water" without taking into account the mineral content of the water. It is now a waste product. Only one serious attempt has ever been made to utilize this material. At Sand Springs a plant is now in operation using deep brines from the "Wilcox" sands. Otto Martin first conceived the idea of utilizing these brines and designed the plant of the Sand Springs Chemical Co.

Western Oklahoma contains immense deposits of gypsum, usually in the form of rock gypsum. This material occurs in ledges varying in thickness up to 100 feet, exposed on the surface in 20 counties. It is estimated that there are 133,000,000,000 tons of gypsum in the State. One company, the United States Gypsum Co. is now manufacturing twenty-seven different products from the rock gypsum.

In connection with cotton seed oil extraction it may be mentioned that there are more than 50 crushing plants within the state in which 295,000 tons of seed were pressed, yielding oil at the average rate of 284 lb. per ton or over 80,000,000 lb. of oil, this being the annual average based on a 5-yr. period.

HAVING outlined briefly a few of the products now being manufactured in Oklahoma let us examine some of the uses for chemicals in this State. In this regard Oklahoma does not differ materially from other states.

A partial list of Oklahoma industries, consuming chemicals, of various kinds consist of petroleum refineries, packing houses, cement plants, glass factories, city water works, cottonseed oil compressors, zinc smelters, flour mills, laundries, creameries, cleaning works, nitroglycerine or torpedo magazines, one sulphuric acid plant, one dyewood and tanning plant, two small lime plants, one salt and brine product works, several wholesale drug houses, and a textile cotton mill.

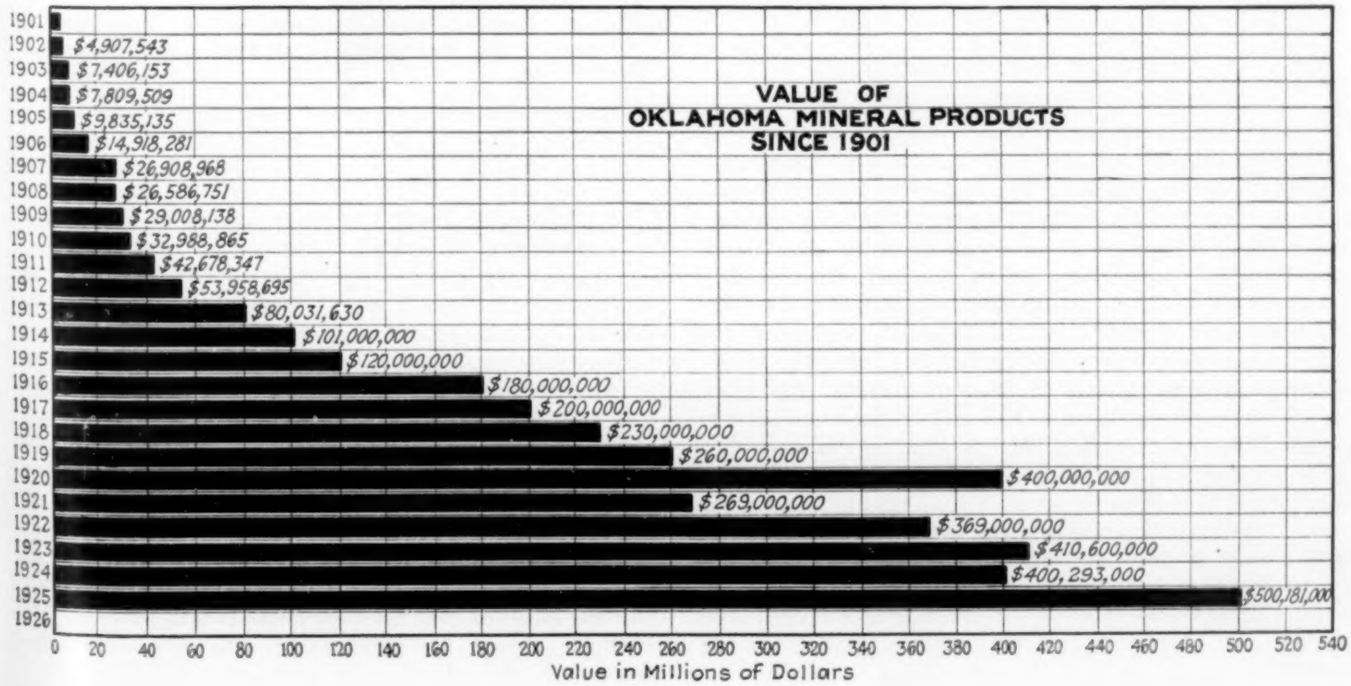
It has already been noted that in order of numbers and importance the oil refineries easily rank first. Naturally those chemicals employed in refining petroleum are those which are used in greatest amounts. Of these there are many, but we can here cite but two.

It has been estimated that it requires 0.2 lb. of 66 deg. Be. sulphuric acid to refine one gallon of average Oklahoma crude oil. Oklahoma refines approximately 4,000,000,000 gallons of oil per year, therefore the consumption of H_2SO_4 amounts to 200,000 tons per year with but a single plant within the State to furnish this important chemical. Naturally the great bulk of acid comes from out of the State. Likewise the consumption of caustic soda is correspondingly high in this particular industry, while records show no alkali manufacturing plants in Oklahoma.

Possibly the manufacturing industry of next importance in quantity of bulk chemicals consumed is the glass works. Glass sand, salt cake, soda ash, and lime are the important products consumed in the manufacture of glass. There are about a score of glass plants within the State, but there are at present but two small lime plants within the Oklahoma borders to furnish lime for this and other industries. No salt cake, soda ash or alkalis other than lime are produced in Oklahoma. Glass sand of high quality and ample in amount is present in Oklahoma, but much of the glass sand used comes from other states.

A considerable portion of Oklahoma lies in the hard-water belt, therefore, the various city water works use considerable amounts of lime, alum, sulphate of iron, and chlorine. To cite a single example, the lime for the water works at Oklahoma City comes from Missouri, the alum from Illinois, the sulphate of iron from Alabama, and the chlorine from Niagara Falls, New York.

In conclusion it should be recalled that Oklahoma is just now entering into a period of prosperity and that while her industries are as yet undeveloped this condition will not long continue. Transportation facilities are most excellent both by rail and along the ever increasing public highways. Labor is generally of a satisfactory character, and in sufficient quantity for all, except, perhaps some seasonal occupations. Because of an abundance of fuel including oil, natural gas and coal, power is everywhere adequate, and the state will probably be well provided with abundant hydro-electric power in the near future.



CHEMICAL ENGINEER'S BOOKSHELF

Critical Data for Industry

INTERNATIONAL CRITICAL TABLES OF NUMERICAL DATA, PHYSICS, CHEMISTRY AND TECHNOLOGY, VOL. II. Prepared under the auspices of the International Research Council and the National Academy of Sciences, by the National Research Council of the United States of America. Editor-in-chief, *Edward W. Washburn*, Ph.D.; associate editors, *Clarence J. West*, Ph.D. and *N. Ernest Dorsey*, Ph.D.; assistant editors, *F. R. Bichowsky*, Ph.D. and *Alfons Klemenc*, Ph.D. McGraw-Hill Book Company, Inc., New York. 616 pp. Price $12.

EDITOR'S NOTE. Technologists in the chemical engineering industries have awaited the appearance of this volume of the International Critical Tables with unusual interest since it deals almost exclusively with the characteristic properties of industrial products and engineering materials. Obviously in covering the broad field of industry as a whole, it has been necessary to treat of the widest variety of subjects. It is equally obvious that no single reviewer is competent to give a critical appraisal of the contents of the entire volume. For that reason *Chem. & Met.* has divided the assignment among a number of technologists who are closely in touch with scientific and industrial research in the various fields.

Seven major sections of the volume, covering in all 501 of its 616 pages, are reviewed here. Some important sections which could not be treated in the present review deal with such miscellaneous subjects as wood and lumber, building stone, textile fibers, artificial plastics, commercial carbons, insulation, paint and varnish raw materials, toxicology, air conditioning, refrigeration and screening.

* * * *

Clays and Ceramic Materials

Clays, heavy clay products and sand-lime brick, porcelains and whitewares, refractory materials, abrasive materials, properties of glass, chemical durability of glasses, vitreous enamels for metals, structural cements, limes and plasters, magnesia cements and concretes, dental cements. Pp. 64-129.

Reviewed by P. H. BATES
U. S. Bureau of Standards, Washington, D. C.

THIS section presents certain physical constants of stone, clays, heavy clay products, porcelains, abrasives, glass, vitreous enamels, hydraulic cements, lime, gypsum, and magnesia cements. Data are presented which show the range in values of some or all of such properties as thermal expansion, conductivity and diffusivity, bulk density, specific gravity, compressive, tensile and transverse strength, heat absorbed during firing, refractive indices, porosity, fusing ranges, durability, effect of composition on certain of these properties. Far from all of these properties are covered in any one of the commodities concerned. This is due to the fact that such commercial products are subject to investigation only along the lines of their manufacture and major uses. Thus, the thermal or electric conductivity of portland cement is of value, but those engaged in its manufacture or in designing concrete structures have so much more use for compressive or transverse strength and modulus of elasticity, that investigators have confined their work to such data as is more needed.

It is pleasing to note that a number of the editors have called particular attention to the fact that such materials, either naturally occurring or manufactured, as are covered in this section will have properties whose numerical values cover quite a wide range. Thus it is stated regarding electrical porcelains: "These figures can be used only as a general guide, since they do not portray the effects of the different varieties of clay, feldspar and flint, or the methods of grinding, etc."

Regarding the durability of glass it is stated: "In the measurement of the durability of glasses, results may be duplicated with accuracy of 5 to 10 per cent only."

The usefulness of such tables with those directly concerned with these industries is small. Of necessity, within the space available it was not possible to indicate the effect of many variables upon the many properties. Hence the technician will have to have recourse to the journals and publications of the trade and scientific organizations directly interested in these diverse industries, wherein in the course of years it is possible to cover in some details the variables which make the preparation of brief, concentrated tables so difficult. However to those who may be brought into contact with these commodities but infrequently the tables are of great value, if what causes the variation in range of values presented are borne in mind. In the case of all the products concerned there is a sufficient number of references to literature to enable anyone who may wish to study some problem in detail to become quite well acquainted with other published data covering what has been done in that connection.

* * * *

Solid, Liquid and Gaseous Fuels

Solid fuels, petroleum, petroleum products and commercial oils of mineral origin, flash points of saturated vapors, detonation characteristics of certain fuels, lubricants and lubrication, gaseous fuels, asphalts and mineral waxes, tars, pitches and distillates, explosions and gaseous explosives. Pp. 130-195.

Reviewed by A. C. FIELDNER
U. S. Bureau of Mines, Pittsburgh, Pa.

UNDER solid fuels are given tables of percentage composition of United States coals arranged according to the Parr system of classification and a table of composition of typical world coals, but unfortunately without reference to source of analyses, size of coal, and whether mine or delivered coal samples. The low figures for moisture and ash values for some of the foreign coals raise the suspicion that some of the analyses are picked samples. Certainly the 14.42 per cent moisture for Saxon brown coal represents an air-dried coal. Other "constants" are density, porosity, specific heat, spontaneous combustion, weathering, and deterioration, coking behavior, ignition temperature, and combustibility of coke. In view of the great variation in such values for different kinds of coal, the references to original literature on these subjects are given rather than the data themselves. On the whole, solid fuels have not been given

the attention and space which their industrial importance demands.

On the other hand a large variety of chemical and physical constants, chemical analyses, approximate compositions, and distillation tests arranged in tabular form according to the different oil fields of the world, are given for petroleum and petroleum products. The data with original references, are well selected and usefully arranged for the technical reader. A section on lubrication and lubricants, a useful table on flash points of combustible organic liquids, and a list of "anti-knock" compounds and their relative effects completes the section on liquid fuels.

Industrial chemists will find the classification, nomenclature, and properties of asphalts and mineral waxes, and similar tables for tar, pitches, and tar distillates compactly presented and bearing evidence of authoritative selection.

A short section on gaseous fuels includes typical analyses and properties of several natural gases, blast-furnace gas, coal-gas, coke-oven gas, carburetted-water-gas, producer-gas, and oil-gas. A unique feature of presentation is in giving analyses for gases of various B.t.u. content for the usual range of the different types of manufactured gas.

Gaseous explosive mixtures have been thoroughly covered, and data on ignition temperature, electrical ignition, limits of flammability, propagation of flame, detonation, and explosions in closed vessels are given in convenient tabular form, with full references to literature, and indication of experimental method used. It appears that the available data on all combustible gases and vapors are included. These should be extremely useful to engineers and research men.

* * * *

Oils, Fats and Waxes

Animal and vegetable oils, fats and waxes, adhesives and gelatins. Pp. 196-231.

Reviewed by G. S. JAMIESON
U. S. Bureau of Chemistry, Washington, D. C.

THIS section on oils, fats and waxes contains a large quantity of useful data on the chemical and physical properties of these substances, which for the most part are arranged in compact tables. References to the literature from which the data has been selected will be found at the end of this section. To conserve space, numbers which are used in various tables have been assigned to each substance listed under the index of common names which are arranged in alphabetical order. In the tables of common properties, the fats and oils have been arranged according to the Alder Wright system. In addition to the usual chemical and physical characteristics, much of the available data is given on the composition, specific heat, heat of combustion, thermal expansion, flash point, viscosity, electrical conductivity and dielectric constant of the oils, fats, and waxes.

The introductory paragraphs of the section on adhesives and gelatins briefly mention the various classes of organic and inorganic adhesives and give directions for the preparation of liquid glue along with the range of American grades devised by the author, Mr. Jerome Alexander, suitable for different purposes. Much data of practical use will be found on the shearing and tensile strength of all important adhesives, for which data is available. Likewise the "viscosity" and "jelly strength" of glues and gelatins receive considerable attention. In addition to the numerous tables of data and other information on the chemical and physical properties of these substances, there are 63 curves which add much to the value of this section.

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Leather and Tanning

Tannins and vegetable tanning materials, leather. Pp. 239-253.

Reviewed by GEORGE D. MCLAUGHLIN
Department of Leather Research (Foundation Tanners' Council of America) University of Cincinnati, Cincinnati, Ohio.

THE section entitled "Tannins and Vegetable Tanning Materials" represents the result of painstaking effort so condensed that anyone outside the field may fail to appreciate the immense amount of work involved. The authors have assembled, in orderly and complete fashion, in eleven pages, practically all the available data proper for these tables. As they point out, the organic chemistry of the tannins is still an infant science. Therefore, much of the chemical data given may require revision as future researches bring newer and sounder knowledge. The data do accurately represent, however, what is now known and should prove of value to all those interested in the science or practice of tanning.

The word "tannin" is a general term used in the tanning industry to designate any vegetable organic substance which combines with animal skin to form leather. As a result, the percentage of "tannin" which a given tanning material may show will vary with the analytical methods employed. The differences noted by the authors between two analytical methods illustrate this. The A.L.C.A. method is an empirical estimation of all those bodies which apparently function in leather formation under plant operating conditions. This method has been found to give an approximately correct estimation of the commercial value of different tanning materials. The Wilson-Kern method empirically estimates those bodies which combine with skin most rapidly and tenaciously. Until more is known of the pure science of skin proteins, tannins and the combination between the two, the problem of tannin definition will remain empirical.

In the section entitled "Leather," the author has assembled information (obtained in his own laboratory) which should be useful to all leather users. As he has often pointed out, leather is used because of peculiar qualities it possesses. Yet we find one of the oldest of industries almost devoid of dependable data and knowledge of the cause of those qualities. It is to be hoped that when the next edition of the "Tables" is published much more information on this subject will be available.

* * * *

Rubber Technology

Rubber, gutta percha and balata. Pp. 254-293.

Reviewed by R. P. DINSMORE
The Goodyear Tire and Rubber Company, Akron, Ohio.

RUBBER, Gutta-percha and Balata, by G. S. Whitby, will be of interest to every rubber technologist. The author has been successful in preparing a summary of the facts relating to rubber which makes the information readily accessible.

Composition and properties of latex, the preparation of crude rubber, and the properties of vulcanized and unvulcanized rubber are covered in some detail. Vulcani-

zation effects and the properties imparted by fillers and softeners are classified and presented in both tabular and graphic form.

The usual difficulties have been encountered due to the ambiguity of the term, "rubber," and, the necessity of specifying the conditions of preparation and the composition. Trouble has also been caused by the lack of standard criteria for the comparison of rubbers. There seems to be little doubt, however, that the author has surmounted these difficulties, as far as the information available would permit.

Indexing, sub-heading, and fidelity of literature references should make this section one of immense benefit to rubber technologists. Some of the material employed is old and its value may be questioned, but, undoubtedly, the author has selected as wisely as anyone could have done, and, in each case, the literature references allow one to draw his own conclusions as to the nature of the work quoted. Doubtless, some will notice the absence of certain data which might have been included at the expense of more doubtful references but there will be hearty agreement that the present section is a splendid compilation of useful information for which there has long been an urgent need.

* * * *

Sugar Technology

Saccharimetry, the properties of commercial sugars and their solutions. Pp. 334-55.

Reviewed by H. W. Dahlberg
The Great Western Sugar Company, Denver, Colo.

SACCHARIMETRY, the Properties of Commercial Sugars and Their Solutions, of the International Critical Tables, is by Frederick Bates, F. P. Phelps and C. F. Snyder. The introduction to this section covers the broad field of saccharimetric methods and standards, with paragraphs devoted to specific rotation, mutarotation, international sugar scale, quartz control plates, and optical rotation for different wave lengths.

Naturally a large part of the data and tables are devoted to sucrose, this being the most important of the sugars, but very complete data are also given for lactose, maltose, dextrose, levulose, invert sugar, mannose, galactose, arabinose, xylose and raffinose. The authors have included nearly all of the important tables which have a bearing on sucrose, among them being: Refractive index of aqueous sucrose solutions, table for use with Zeiss immersion refractometer, density of aqueous sucrose solutions, solubility table, freezing point data, and inversion with HCl and with invertase.

Most of the data for sucrose are already familiar to research workers and technologists in the cane- and beet-sugar industry, but it is of value to have all of the information tabulated in one section. However, much new information and other data not readily available is published on the other important sugars mentioned above, and men engaged in sugar research will find this latter section worthy of careful study.

In view of the importance of raffinose in the beet sugar industry, its effect on the solubility of sucrose, and its influence on the rate of growth of sucrose crystals, it is to be regretted that more information concerning this widely distributed trisaccharide is not made available. The reviewer also ventures to hope that future editions of the saccharimetry section may include some of the excellent research work on "Crystallization of Sucrose" by Professor Kucharenko and associates of Kiev. Among the very important sucrose compounds from the industrial standpoint are the calcium, strontium and barium saccharates and the writer desires to recommend that the properties, solubility relations, etc., of these be studied. This information would be of value to the sugar industry of the United States and Europe as well.

The section closes with a list of rotations and melting points of pure sugars and sugar derivatives, covering about one hundred of these compounds. The authors have shown excellent care in listing all literature references, so that the reader may readily refer to the original sources of information. There can be no question that they have covered in a very satisfactory way the information now available on the most important sugars.

* * * *

Metals and Alloys

Properties of metals and alloys, finding index of alloys, symbols, equilibrium diagrams, thermal expansion, iron-cobalt, iron-titanium and titanium and uranium steels, nickel and its alloys, cast iron and C, Cr, Cu, Ni, and V steels, Mn and Si steels, aluminum and its alloys, zinc and its alloys, cadmium and its alloys, copper and its alloys, copper and bronze, aluminum bronzes, Ag, Au, Hg, Ir, Os, Pd, Rh, and Ru, fatigue of metals and alloys. Pp. 358-611.

Reviewed by Edgar C. Bain
Union Carbide and Carbon Research Laboratories, Long Island City, L. I.

WITH the distribution of the Second Volume of the International Critical Tables the metallurgist is provided with the most concentrated 250 pages of information that he has ever had available. This new tool is one of multifarious utilities and because of this very fact the metallurgist may have to take time to learn to use his new equipment. Indeed during the search for his first item of knowledge he may regard his task a formidable one, but the outstanding fact is that he will be consoled by really finding, in most cases, all he sought, and his succeeding references will be much easier.

The work, but for the complete use of abbreviations and symbols would have been impossible even in one language, but the volume is very nearly, if not quite, as easily employed by a user with only German, French or Italian at his command. The symbols, however, are more generally logical abbreviations of the English words than of the others. The absence of the English units such as lbs. per sq.in. (or Fahrenheit temperatures) results in merely the usual ill-fortune accompanying our reluctance to forget them; the practice in the metric and C.G.S. system will perhaps be beneficial.

With the great and small indexes provided to act as guide posts the unwieldiness of the volume chiefly disappears. By way of testing this point the reviewer experimented somewhat. A person with no specific knowledge of metallurgy was asked to find a certain equilibrium diagram, to find the ultimate tensile strength of a certain low manganese steel and the coefficient of thermal expansion of the special 35 per cent nickel-iron alloy. The equilibrium diagram was returned in one and a half minutes from the time of first seeing the volume. The ultimate tensile strength figure required only four minutes to locate—a little lower value, by the way, than we are accustomed to regard it—and the search for the thermal expansion of Invar was found in about three minutes. But this last search netted not only the answer to the enquiry, but in addition the value of the second parameter of the equation involving temperature and the

variation of the general expansion with change of nickel and the effect of chromium and manganese on the series! A very good yield for a single reference by an inexperienced person.

The 230 binary equilibrium diagrams are an achievement in clear chart making. The present reviewer has always favored the absence of composition and temperature co-ordinate lines in a diagram and these diagrams, in uniform style, employ only pointer lines at the boundaries to designate the values with resulting lucid delineation of the phase locations. It is debatable whether atomic concentration figures should have been added in a non-linear scale in the manner of Guertler. There is no doubt that the theoretical metallurgist in particular would welcome this additional aid at times.

In compiling binary equilibrium diagrams there is always a great deal of dissatisfaction in the task. Most of them are inevitably in error. The lack of interest in a certain range of composition due to its useless nature leaves the diagram spotty with inaccuracies. And again, the older investigators usually had at hand only impure materials for use in melting. How long has very pure chromium been available? or zirconium, beryllium, vanadium and manganese? And if a series shows little promise of commercial value who will undertake the task of constructing its diagram accurately? In these tables we have very probably the best available information. But one does wonder just how much out of date a reference work necessarily must be or how much lag is to be condoned between the scientific papers and the books of compilation. Thus, Professor Desch does not show the diagrams for Iron-Tungsten or Iron-Molybdenum as painstakingly determined by Sykes and published early in 1926. Prior to that time Oberhoffer had published in *Stahl und Eisen* (1925, 45, 1629) the contours of the gamma iron and alpha iron solid solutions as influenced by vanadium reported as unknown in the diagram. In all diagrams involving iron the story is very poorly told if the matter of allotropy is ignored, as it is in four or five of the diagrams. Happily the Iron-Silicon and Iron-Tin diagrams are drawn according to the very latest researches even though the Iron-Chromium diagram is incomplete. More recent work upon the Iron-Cobalt alloys indicates a different disposal of the austenite-ferrite regions, the alloys up to 80 per cent cobalt being actually ferritic, and beyond this composition they are austenitic at room temperature.

But a pleasant surprise are the understandable ternary diagrams of which there are perhaps thirty. When accurate knowledge is lacking trends are sketched—often quite as valuable if used as such. If one doubts the data as indicated he should bear in mind that a book of tables cannot well report scraps of fine research but can only broadly supply abstracts of the corroborated material.

The mechanical properties of the various steels are exceptionally well treated in the Tables. Not only are a number of representative data offered for each type of steel in the customary state of heat-treatment but much helpful information as to trends and fundamental natures is supplied by graphic representation of properties as affected by various changes in drawing temperatures, quenches, and small changes in composition. The tables and charts are invariably specific as to exact composition and heat-treatment. While about 15 rustless irons and steels are listed the charts showing mechanical properties at elevated temperatures are worthy of a much larger and more detailed work. (More than 11 pages are devoted to aluminum bronzes which seem perhaps out of proportion to the space given to some valuable steels.) In the Finding Index it would have been convenient to have found magnet steels or die steels listed in the same manner as spring steel or the Heussler alloys, for instance. If the valuable 10 per cent chromium-2 per cent carbon die steel is mentioned it is extremely well hidden.

Of interest to the student is the finding of unusual bits of information—as for instance the hardness of the Mercury-Thallium series of alloys. The miscellaneous columns are full of rare and surprising data.

The metallurgist will be disappointed to find no American high speed steel listed in the index—only English brands, and no properties mentioned even for them except thermal expansion—not exactly a paramount consideration in that steel which is so important to the enormous automotive industry. Cutting behaviors, hardness or tensile strength as affected by heat treatment are probably as important to metallurgists in general as the more or less obscure bronzes so minutely discussed.

Regardless of the criticism that a few isolated omissions may cause, the metal section of the International Critical Tables is destined to be the reference book most often consulted in the metallurgist's library—that is, until some huge volume for his exclusive use is issued.

A Textbook for the Gas Industry

MANUFACTURED GAS. Volume I—Production. By *Jerome J. Morgan*, associate professor of chemical engineering, Columbia University, New York City. Published by the author. 518 pp. Price $7.50.

Reviewed by G. L. MONTGOMERY
Assistant Editor of Chem. & Met.

THIS very complete work is something that has been long awaited, a book on modern American practice in manufacturing gas. Our English cousins have been prolific along this line, to say the least; but American authors have failed recently to give us any thorough treatment of this important industry.

The first of the two volumes, dealing with the production of gas, was issued over a year ago in the form of pamphlets, used by Professor Morgan in his course at Columbia. The second volume, taking up the remaining phases of the industry, is at present in pamphlet form, and its publication as a book may be expected in the near future.

This first volume deals with the physical and chemical properties of manufactured gas; the methods of, and apparatus for, production; and the new methods, such as low temperature carbonization, which are now being investigated. Its treatment of these subjects is thorough, both from the scientific and engineering standpoints. The illustrations are splendid. And the explanations of processes and operations are detailed but clear.

The only adverse criticism that can be made of this book is of its physical make-up. Instead of the customary type, the book has been reproduced by a photographic process from typewritten sheets. As a result it is hard to read, the width of the column, in particular, being too great for the comfort of the eye. It is sincerely to be hoped that the present edition will be soon replaced by a more readable one.

In spite of this hurdle which the author has put in the path of the reader, it is certain that this volume will have wide acceptance. It is authoritative and it removes the necessity for the gas engineer translating European or English practice into terms of American conditions.

READERS' VIEWS AND COMMENTS

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

Is Cobalt an Impurity in Nickel?

To the Editor of Chem. & Met.:

Sir—In the report in your May, 1927, issue of the metallurgical features of the Philadelphia meeting ot the American Electrochemical Society there appears a statement attributed to R. J. McKay which reads:

> "Cobalt is in all ways analogous to nickel, its physical properties and chemical reactions being practically identical."

It is difficult to believe that such a statement was intended seriously, but both this paragraph and its context appear to be an attempt once more to foster the idea that in estimating the purity of refined nickel the two elements may be treated as identical.

In these modern times when every refiner of the elementary metals of commerce is striving for a high standard of purity such an idea is seriously retrogressive. Every chemist know that the "chemical reactions" of nickel and cobalt have very striking differences and no metallurgist having any experience with *both* metals will need to be reminded of the equally striking differences met with in their behavior either as pure metals or (even in greater degree) as components of alloys—ferrous or non-ferrous. Typical illustrations of these vital differences will be found in a study, e.g., of the nickel-copper and the cobalt-copper series in the non-ferrous, and of cobalt steel and nickel steel in the ferrous fields.

But it is not necessary to pursue such a line of argument to bring this matter to an issue. The obvious point is that the nickel refiner cannot legitimately claim a privileged position, denied—and rightly denied—to any other metallurgical refiner. The refining of all other of the notable metals of commerce—copper, silver, aluminum, zinc, tin, lead, etc., presents certain difficulties arising from the presence of closely related elements, some even more closely related than nickel and cobalt, and in several instances it has been found impossible to eliminate them entirely. When this is so it is plainly stated in the analytical reports and provided for in standard specifications. But in every case the assay value claimed for the particular metal is that of itself *alone*. In no other field of metallurgy is the attempt made to bring in any "analogous" element in order to claim a higher standard of purity.

It is an attempt subversive of metallurgical ethics and so long as it is made in the nickel world any nickel refiner who can honestly do so is entitled to use the slogan "free from cobalt" and slighting references to this are entirely unjustifiable.

W. R. BARCLAY,
Technical Director.

The American Mond Nickel Company,
Clearfield, Pa.

To the Editor of Chem. & Met.:

Sir—Mr. W. R. Barclay has taken exception to my recent statement that "Cobalt is in all ways analogous to nickel, its physical properties and chemical reactions being practically identical."

The writer is very pleased to learn that Mr. Barclay has brought up this question, as it is one worthy of the attention of both research and practical metallurgists. His point is well taken, that it would be retrogressive to allow the practical fact that a small amount of cobalt in nicked cannot be considered an impurity in the best dictionary sense of this term to detract from scientific studies of the properties of chemically pure nickel. I urgently hope that my statements will not have this effect, and that research students in universities and elsewhere, where the time is available, will not fail to continue their valuable work on chemically pure metals, including nickel.

The variations between the nickel-copper and the cobalt-copper series, and the nickel-iron cobalt-iron series are interesting phenomena very worthy of metallurgical research. This is mainly true because of the broad similarly between the two metals. Mr. Barclay claims that other metals show as close similarities. I would take exception to this. I know of no two metals as closely similar, and Mr. Barclay has not mentioned any such, although there are of course many cases of interestingly similar properties. I would not, for instance, class the somewhat milder effect of cobalt in increasing the strength and toughness of steel as a dissimilarity from nickel. The important fact seems to me that it does increase strength as does nickel.

It would be just as great a mistake to allow theory to detract from the proper practical use of commercially pure nickel, as to retrogress in research. I therefore emphasize my former statement that the amount of cobalt present in the ordinary grades of commercially pure nickel is unimportant in the use of this nickel, and that attempts to magnify its importance are not based on a desire for scientific or engineering accuracy. This statement is founded on considerable experience in the use of nickel, with and without small amounts of cobalt present, and must stand until someone can bring forward definite instances where the presence of cobalt does have practical significance. In spite of Mr. Barclay's interesting presentation of his case, he has not brought forth any such instances.

ROBERT J. MCKAY,
Superintendent of Technical Service.

The International Nickel Co.,
New York, N. Y.

Selections from Recent Literature

CLEAN COAL. H. Louis. *Chemistry and Industry,* June 17, pp. 545-52. Pure coal is defined as containing only intrinsic water and ash (inorganic matter). Methods and equipment for removing adventitious impurities are then discussed. Among the principles utilized in coal cleaning are: differences in specific gravity and in frictional resistance; air cleaning; washing, and flotation. Appliances include trough washers, shaking tables, dust collectors, settlers and spiral (friction) separators.

MOTOR FUEL. F. L. Nathan. *Journal of the Society of Chemical Industry,* June 17, pp. 211-20T. The gasoline situation; benzol and tetralin as possible substitutes; production of alcohol in the British Empire from cheap waste cellulose, from ethylene or from carbide; liquid fuels from coal; synthetic methanol; coal gas and producer gas. The probability of urgent need for a gasoline substitute is remote.

CHEMICAL PLANT. Ernst Blau. *Chemiker-Zeitung,* June 1, pp. 409-11; June 8, p. 431. Illustrated description of some new special designs in ventilators, high speed evaporators and turbine effect mixers. The Dreika turbomixer is intended for simultaneous pulverizing and mixing. Blowers, fans and steam condensers are also described.

FOREIGN TRADE. *Chemische Industrie,* June 4, pp. 604-6. Tabulated statistics of Italy's exports and imports of about three hundred chemical items for 1925 and 1926. Amounts and values are reported.

RAYON. *Chemische Industrie,* June 11, pp. 626-8. A statistical review of the world's artificial silk industry for the calendar year 1926, compared with 1925. Separate figures are given for the principal producing countries.

OIL FROM ETHYLENE. M. Otto. *Zeitschrift für angewandte Chemie,* June 16, p. 700. An active accelerator of the polymerization of olefines is BF_3. No pressure is required for the higher olefines (e. g. liquid isobutylene; but with ethylene and propylene high pressures (up to 130 atm.) are required for successful operation. The products are heavy oils. Ni is an active promoter of the catalytic polymerization.

COLLOID MILLS. O. Auspitzer. *Zeitschrift für angewandte Chemie,* June 16, p. 725. A brief account of the development of the Plauson mill, and the difficulties encountered in arriving at satisfactory results from the standpoint of dispersing agents, peripheral speeds, number of revolutions and transition from laboratory to factory size mills.

ACID FILTRATION. *Chemiker-Zeitung,* June 11, pp. 442-3. An illustrated description of the application of the Wolf porous filter and suction drier to the filtration of acid sludges. Acid protection is given by coatings of lead, hard rubber or the like, each installation being constructed according to the conditions to be met.

SILICON. Rudolf Hölbling. *Zeitschrift für angewandt Chemie,* June 9, pp. 655-9. In making Si by reducing $SiCl_4$ with H_2, the reaction is very sensitive to small amounts of impurities. The reagents should be well purified, and the gas train should be all glass, with connections fused together. Curves are given showing the specific resistance of pure Si from 25 to 800 deg. C.

AMMONIUM THIOCYANATE. W. Gluud and W. Klempt. *Zeitschrift für angewandte Chemie,* June 8, pp. 659-60. In the purification of coke oven gas, if the HCN is to be removed and recovered separately from the H_2S the thiocyanate process is the most economical, provided the ammonium thiocyanate can be marketed. Increased consumption of the thiocyanates in industry would therefore be beneficial to coke producers.

LEAD COATING. M. U. Schoop. *Zeitschrift für angewandte Chemie,* June 8, pp. 672-3. Illustrated description of the Schoop gun for coating surfaces with a spray of finely divided lead.

FURFURAL. T. H. Fairbrother. *Industrial Chemist,* June, pp. 243-4. A brief review of the production and commercial importance of furfural as a chemical raw material.

ZINC OXIDE. D. R. Johnston. *Industrial Chemist,* June, pp. 245-7. Modern practice and equipment in the production of ZnO for use as a pigment in paints and rubber. Illustrated.

HYDROGENATION. E. J. Lush. *Industrial Chemist,* June, pp. 249-56. Illustrated description of processes and plant for continuous catalytic hydrogenation: making and preparing the catalyst; hydrogenation procedure; semi-factory scale operations.

SUGAR EFFLUENT. A. J. V. Underwood. *Industrial Chemist,* June pp. 260-4. There is no treatment of beet sugar effluents which is efficacious in all cases. Much depends on accurate chemical control of the treatment. Analysis of waste from beet sugar refineries are given.

LAMP BULBS. A Salmony. *Chemiker-Zeitung,* May 25, pp. 389-91. Illustrated description of methods and machinery used in modern large scale production of electric light bulbs. A two arm Westlake machine, a three burner annealing oven, a melting machine and a blowing machine are among the items illustrated.

WOOD IMPREGNATION. Friedrich Moll. *Zeitschrift für angewandt Chemie,* May 26, pp. 583-5. In the present state of the art, the most practical and uniform results in wood impregnation are obtained by pressure impregnation in closed cylinders or by prolonged soaking in open tanks. Methods depending on osmosis, dialysis, electricity and the like have not yet shown themselves to be equal to the older processes. Methods of improving penetration are discussed.

PHOSPHATES. W. Stollenwerk. *Zeitschrift für angewandte Chemie,* June 2, pp. 613-20. The conversion of raw phosphate by sulphuric acid proceeds in two stages. The first, which liberates two thirds of the phosphoric acid, is rapid; the second is slower. A study was made of the amount of iron dissolved out of phosphate rock under given conditions, and of the proper conditions for complete conversion of raw phosphate by sulphuric acid. Numerous tables and curves are shown.

COAL GAS. Hamilton Davies and Harold Hartley. *Journal of the Society of Chemical Industry,* June 3, pp. 201-6T. The products of combustion of coal gas were analyzed with great care and accuracy, with the principal object of determining the amount of CO escaping unburned under prevailing conditions of use of coal gas. Flames burning of CO to CO_2 were determined for combustion in a well aerated Bunsen, a poorly aerated Bunsen and in the luminous flame.

STORAGE BATTERIES. M. Wildermann. *Journal of the Society of Chemical Industry,* June 3, 504-8. Methods are described for determining the performance characteristics of accumulators. The tests include electrical resistance, rate of absorption of solution by separator sheets, rate of percolation, and general performance tests.

FIRE EXTINGUISHERS. W. R. Ormandy. *Journal of the Society of Chemical Industry,* May 27, pp. 482-5. A brief review of the construction and use of chemical fire extinguishers (hand or portable), with particular reference to fire protection in chemical plants.

RAW PHOSPHATE. Wilhelm Stollenwerk. *Zeitschrift für angewandte Chemie,* May 19, pp. 553-9. Raw phosphate can be converted to a soluble form by treatment with a six-fold excess of sulphurous acid. The conversion is not complete if ammonium sulphites are used instead of the free acid. The soluble salt which is formed is Ca biphosphate, and the reaction is sufficiently slow so that the salt can be obtained pure. Ca monophosphate cannot be obtained directly from aqueous solution by evaporation; it changes to the biphosphate and free phosphoric acid.

CHEMICAL PRODUCTS. H. Bausch. *Zeitschrift für angewandte Chemie,* pp. 568-70. A comparison of prewar and present production and values of Pt, Hg, I, Br, asbestos, carbide, rubber, rayon, fixed N; German statistics are compared with those of the world and of some large producing nations.

X-RAY INSPECTION. Curt Plonait. *Kunststoffe,* June, pp. 125-7. In the growing number of industrial applications must be included the successful use of an installation for detecting internal defects in pressed amber goods. The device is operated by girls, with due precautions against health hazards.

Celluloid Boxes. A Bahls. *Kunststoffe,* June, pp. 129-30. A machine for bending strip celluloid into box form is described and illustrated. The platform and bending beam may be heated, preferably by electricity.

Raisin Seed Oil. Carriere and R. Campredon. *Chimie et Industrie,* May, pp. 723-8. Methods and equipment for recovering and refining the oil from raisin seeds are described and illustrated. The oil has a limited market in the United States and Spain as a drying oil for paints, and is used to some extent for making factice. If carefully selected and properly refined, it makes a satisfactory low priced substitute for castor oil for lubricating airplane motors. Its principal market, however, is for making soaps used in the textile industries.

Gas and Coke. Feodoroff. *Chimie et Industrie,* May, pp. 729-36. A quantitative study of the gas balance in coking with the coal from Routchenkovo mines. Sources of loss of gas, sufficient to affect the yield of gas, were noted and the ratio of fuel consumed to yields of gas and coke was measured.

Marine Animal Oils. Henri Marcelet. *Chimie et Industrie,* May, pp. 860-4. Efforts are under way in France to promote the commercial exploitation of the resources of the French colonies in whale, sperm, codliver and other marine animal oils. Production statistics are shown for some of these oils.

Insulation. A. Guentherschulze. *Chemiker-Zeitung,* June 4, pp. 421-2. There is no material which fulfils all the requirements of a perfect insulator. Each problem must be met on its own ground, according to whether a gas, liquid or solid is required and according to the conditions to be met. The theory of electrical resistance is discussed.

Alkali Chlorides. Jean Billiter. *Chemiker-Zeitung,* June 4, pp. 423-4. A short account of current practice (chiefly European) in the commercial electrolysis of the alkali chlorides. Liquid Cl, caustic soda and hypochlorite are among the products discussed.

Tin in Copper. W. Stahl. *Chemiker-Zeitung,* June 4, p. 427. The fact that high-tin bronzes have a higher density than would be expected from the component densities is due to elimination, during the making of the alloy of small amounts of absorbed gases. These include H_2 and CO.

Food Cans. H. Serger. *Chemiker-Zeitung,* May 18, pp. 370-2; May 25, pp. 391-3; June 1, pp. 411-3. The suitability of aluminum as a material for food cans was tested in two ways: strips of Al were sealed in food tins for long periods, and foods were canned in Al and examined after long standing. Numerous fruits, vegetables, meats and fish were included in the food list. The conclusion is that Al cans are in general attacked less than the tin plate now in common use. Keeping qualities of the foods were not impaired.

Combustible Vapor Recorder. O. Dommer. *Chemiker-Zeitung,* June 1, pp. 413-4. A new automatic recording instrument for measuring the amount of gasoline, benzene, ether or like vapors in air. The principle used is that the viscosity of the air varies according to the vapor content. Illustrated.

Asbestos. J. N. Longley. *Chemistry and Industry,* June 10, pp. 525-6. The characteristics and properties of chrysotile (white), crocidolite (South African blue), tremolite and actinolite (the hornblendes) and kindred varieties of asbestos. In mechanical strength and thermal stability, white asbestos is superior to blue; but the blue variety has a somewhat better physical structure for some uses such as in boiler coverings.

Enamel For Metals. *Farbe und Lack,* June 1, p. 314. A new flux, with fluorspar base, makes possible new and superior pigment combinations for producing a wide range of color effects on enameled metals. Recipes and compounding instructions are given for white and several colors.

Coking Coal. Etienne Audibert and Louis Delmas. *Chimie et Industrie,* May, pp. 707-22. A study of the factors governing solidity and coherence in coke. Curves are given showing the relations of temperature; chemical composition, temperature; fluidity, temperature; weight loss; swelling, temperature; crushing strength, rate of heating; crushing strength, and variety of coal; crushing strength. Considerable improvement in coking practice could be effected by intelligent control of the governing factors.

Government Publications

Prices indicated are charged by the Superintendent of Documents, Washington, D. C., for pamphlets. Send cash or money order; stamps and personal checks not accepted. When no price is indicated, pamphlet is free and should be ordered from Bureau responsible for issue.

Thermal Expansion of Graphite, by Peter Hidnert and W. T. Sweeney. Bureau of Standards Technologic Paper 335. 5 cents.

Comparative Tests of Six-inch Cast-iron Pipes of American and French Manufacture, by S. N. Petrenko. Bureau of Standards Technologic Paper 336. 15 cents.

Minnesota Manganiferous Iron Ore in Relation to the Iron and Steel Industry, by T. L. Joseph and F. P. Kinney. University of Minnesota, School of Mines Experiment Station Bulletin No. 12. Obtainable only from the University until supply is exhausted, without charge.

The Manganese Situation from a Domestic Standpoint, by J. W. Furness. Bureau of Mines Information Circular 6034 (Mimeographed).

Some Economic Phases of the Carbon Black Industry, by G. R. Hopkins. Bureau of Mines Information Circular 6033 (Mimeographed).

Methods and Tools for Removing Paraffin from Flowing Wells, by C. E. Reistle, Jr. Bureau of Mines Serial 2802 (Mimeographed).

The Interpretation of Crude Oil Analyses (Bureau of Mines Hempel Method), by N. A. C. Smith. Bureau of Mines Serial 2806 (Mimeographed).

Quarry Problems in the Lime Industry, by Oliver Bowles and W. M. Myers. Bureau of Mines Bulletin 269. 25 cents.

Production of Sponge Iron, by C. E. Williams, E. P. Barrett, and B. M. Larsen. Bureau of Mines Bulletin 270. 35 cents.

Blast-Furnace Gas Studies, by J. F. Barkley. Bureau of Mines Technical Paper 401. 5 cents.

Production of Explosives in the United States During the Calendar Year 1925—With Notes on Mine Accidents Due to Explosives, by W. W. Adams. Bureau of Mines Technical Paper 406. 10 cents.

Mineral production statistics for 1925—separate pamphlets from Bureau of Mines on: Silica, by F. J. Katz, 5 cents; Zinc, by Amy Stoll, 5 cents; Copper, by C. E. Julihn and Helena M. Meyer, 10 cents; and Petroleum, by G. R. Hopkins and A. B. Coons, 10 cents.

Coal in 1924, by James E. Black, L. Mann, and F. G. Tryon, separate mineral production pamphlet from the Bureau of Mines. 20 cents.

Mineral production statistics for 1926 — preliminary mimeographed statements from Bureau of Mines on: Phosphate Rock, Asbestos, Crude Platinum, Metallic Cadmium, Barite and Barium Products, Manganese, Native and Manufactured Asphalts, and Carbon Black.

Production statistics from 1925 Census of Manufactures in preliminary mimeographed form for Miscellaneous Chemical Compounds.

Production statistics from 1925 Census of Manufactures—printed pamphlet on Crossties and Poles, Purchased and Preserved. 5 cents.

Production statistics from Census of Manufacturers in preliminary mimeographed form for periods and commodities named: Glues of Animal Origin—First Quarter, 1927; Edible Gelatin—First Quarter, 1927; Fats and Oils—first quarter, 1927; Domestic Water Softeners—April, 1927.

Production statistics from the Census of Manufactures—printed pamphlet for Animal and Vegetable Fats and Oils—Production, Consumption, Imports, Exports, and Stocks, by Quarters, Calendar Years 1925 and 1926.

Acid Processes for the Extraction of Alumina, by G. S. Tilley, R. W. Millar and O. C. Ralston. Bureau of Mines Bulletin 267. 15 cents.

Fluorspar, its Mining, Milling, and Utilization, with a Chapter on Cryolite, by Raymond B. Ladoo. Bureau of Mines Bulletin 244. 35 cents.

Mineral production statistics for 1926—preliminary mimeographed statements from Bureau of Mines on: Feldspar; Fuller's Earth; Talc; Iron Industry; Gypsum.

Coke and By-Products in 1924, by F. G. Tryon and others, with a Report on The Marketing of Coal Products, by R. S. McBride. Bureau of Mines pamphlet. 25 cents.

THE PLANT NOTEBOOK

an exchange for OPERATING MEN

Quality of Welding Rod Is Important

Among the most important factors in securing good welds by the oxy-acetylene process is the quality of the welding rod, and manufacturers of welding equipment and supplies are devoting much attention to developing new and improved rods.

One of the simpler tests which are commonly used can readily be made by any operator, in order to determine the excellence of his present supply. Place a rod on a welding table so one end extends well over the edge. Then melt it with a blowpipe, watching for impurities or cavities. A good rod will melt easily and quietly with practically no sparkling. Another good test can be made by laying the rod on a metal slab and then remelting it repeatedly. The first time the blowpipe has been moved slowly along, there should be no excessive sparkling, and no pin holes should remain in the melted metal. A second or third application will show proportionately more sparkling and a larger number of pin holes. But if there is a great increase each time the rod is not of very high quality.

A good rod, one which can withstand such tests, gives a good weld because it has no impurities to be left in the weld metal and no gas pockets to prevent steady and smooth flow.

In actual work the operator can recognize good welding rod with no trouble at all. The rod should flow easily without excessive sparkling; it should be easy to control even in overhead welding and should be capable of being worked rapidly.

Temperature Control For Jacketed Kettles

By P. T. Van Bibber
Belmont, Vt.

Automatic temperature control for steam jacketed mixing kettles in which liquids are mixed that generate heat during mixing presents a difficult problem. The present article sets forth one method by which this was accomplished

A temperature controller was installed on one kettle with the bulb immersed in the liquid being mixed. The controller was mounted on a nearby wall, with a diaphragm valve operated by 15 lb. air pressure, mounted on the water inlet pipe to the kettle jacket.

This control was an improvement over hand control, but the chart of the recording thermometer that recorded the temperature of the liquid being mixed clearly showed that the control was not that desired. The chart showed a wide variation in the low points to which the temperature dropped before rising again to a point where cooling water was again introduced. This was due to the large quantity of cold water locked in the jacket after the motor valve closed, which extracted more heat than was desired from the liquid in the kettle before the latter could rise again in temperature due to the heat given off in mixing. The kettle wall was also thick giving a low constant of heat transfer.

Since the kettles were still in good condition and represented a considerable investment, replacing them with new ones having thinner walls and equivalent jacket cooling surface with less space between inner and outer walls was out of the question. The only other

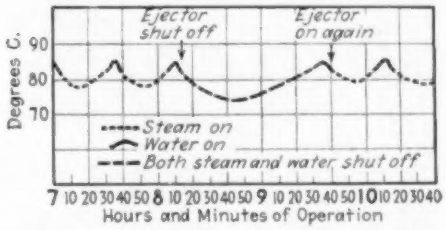


Fig. 2—Curve Plotted from Observations Showing Temperature Fluctuations in Jacketed Kettle with Automatic Control

means apparent for obtaining a more uniform temperature curve was to heat the cold water in the jacket and thus cause the liquid in the kettle to quickly rise in temperature again to the point at which the controller would admit cooling water and prevent further rise. Therefore a steam heater operating on the ejector principle was constructed and installed on one of the kettles.

After some experimenting as to arrangement and pipe sizes, a standard method of connection, as shown in Fig. 1, was adopted. This employs an automatic temperature controller of the "reverse acting" type, which maintains air pressure on the diaphragm of the motor valve until the temperature of the liquid around the bulb reaches a predetermined point, when the air pressure is released and spring pressure operates the valve.

The figure shows how three motor valves were used together, all connected to a common air line and operated from one temperature controller. Two "direct acting" motor valves were used to control the flow of water, one on the inlet and the other on the outlet. The "reverse acting" motor valve was installed on the steam line. While this valve was of ¾ in. size, ½ in. pipe and fittings were found large enough to operate the ejector most efficiently at 40 lb. steam pressure, supplied from the high pressure main through a reducing valve to a common header for all kettles. Larger steam jets or higher pressures did not show any appreciable gain in speed of water heating; but produced water hammer in the circulating pipe and jacket. The sizes of water and circulating pipes were limited to 1½ in. by the flanges on the jacket.

It is evident from the arrangement that, when the temperature of the liquid in the kettle reached the maximum point for which the controller had been set, the air pressure was releasd from the diaphragms of all three valves simultaneously, causing the water inlet and outlet valves to open and the steam valve to close. When the temperature within the kettle was brought below the set point, air pressure closed the water valves and opened the steam valve.

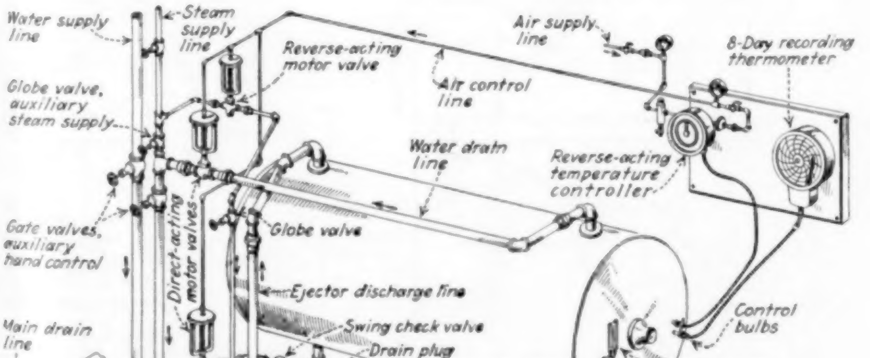


Fig. 1—Layout of Control for Cooling Water and Heating Steam for Jacketed Mixing Kettles

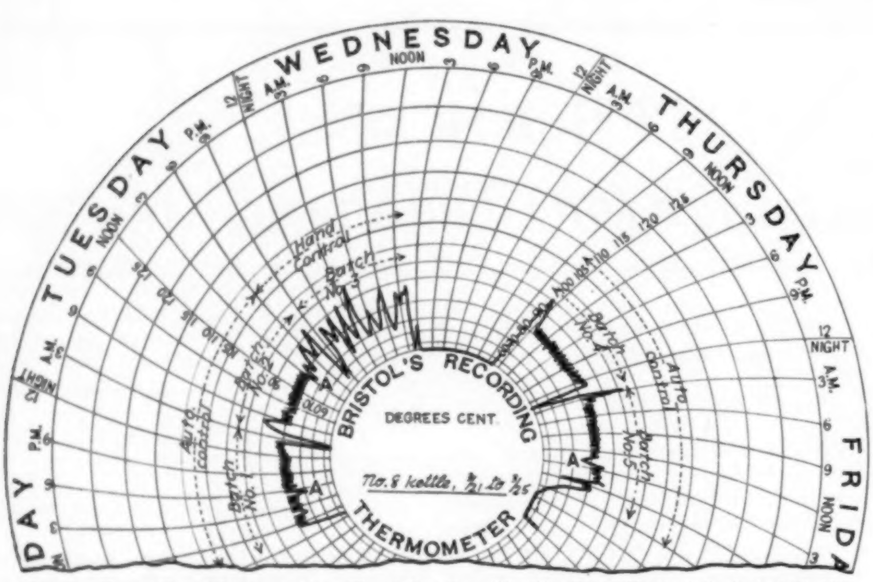


Fig. 3—Recording Thermometer Chart for One Week's Operation of Jacketed Kettle

Still closer regulation could be obtained by introducing the cooling water at the top and leaving an open drain at the bottom of the jacket, so that admission of steam also at the top would force the cold water out after each cycle of cooling, the steam temperature in the jacket then allowing the liquid in the kettle to cool only slightly below the set point on the controller. This could not be done because the alternate contraction and expansion set up in the outer jacket soon caused leaks, as had been demonstrated by hand control. Advantage was taken, however, of steam pressure in the jacket in starting and finishing each batch, care being taken to bring the pressure up slowly. In order to clean the kettle easily after each batch was finished, the quick-opening valve under the kettle between water inlet and drain was opened long enough to empty the jacket of water. The temperature controller then being shut off the two hand valves on water inlet and outlet were closed and the auxiliary steam valve leading into the drain line at the top of the kettle was opened. It was only necessary to maintain this heat in the jacket for a sufficient time to permit the material adhering in the kettle to be scraped off.

In starting a new batch, after the kettle had been filled, hand valves on the water inlet and outlet were opened, and the air supply to the controller turned on. The liquid in the kettle being below the set temperature, the two motor valves on the water lines closed while the steam jet motor valve opened. The pressure then gradually built up in the jacket to 40 lb. This procedure was followed because the generation of heat in the liquid did not begin until its temperature was close to the set point of the controller and it was desirable to have the heat from the steam in the jacket instead of trying to heat and circulate water on the first temperature rise in starting. While the chart showed a peak on this first rise several degrees higher than the average maximum point, due to both the metal of kettle and jacket becoming so much warmer from the high heat of the steam and to the small interval of time required for the jacket to fill after the controller admitted cooling water, this peak was not objectionable.

The curve, Fig. 2, was plotted from observations of the indicating thermometer. The greater difference in temperature limits as it would be without the rise of the steam heating and circulating tee, is shown by this curve, where the jet was turned off during one cycle of rise and fall. The points, *A*, marked on the chart, Fig. 3, for a week's run also show this extra drop when the steam jet was turned off for purposes of comparison. To give a clearer picture of the improvement of using automatic in place of manual control, the third batch in the kettle for which the chart is shown in Fig. 3 was run with hand control. The difference is evident. The saving in mixing time by this control was approximately 30 per cent over the time with hand control.

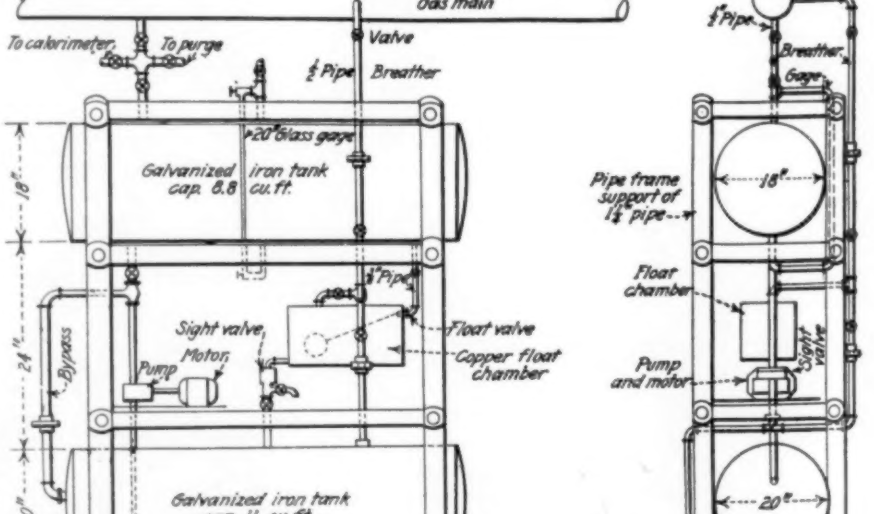
Apparatus for Continually Sampling Gas

In the report of the Water Gas Committee at the recent meeting of the American Gas Association, Mr. L. J. Willien made a suggestion for the design of an apparatus for continuously sampling gas over 24-hour periods.

This apparatus, which is shown in the accompanying drawing, consists essentially of two galvanized iron water tanks mounted in horizontal position on a portable frame made from iron pipe, a float valve suitably inclosed in a chamber, a motor-driven pump and the necessary valves and piping. The upper tank is of 66-gal. capacity and the lower tank is of 82-gal.

Gas is drawn into the upper tank by displacement of water therefrom through a pipe leading from the bottom of this tank into the float valve chamber, which serves to maintain a constant rate of displacement regardless of the height of water in the upper tank. The rate of displacement of water from the upper to the lower tank is controlled by means of a valve in the pipe leading from the float chamber to the top of the lower tank. A sight box and valved bypass serve to make the desired rate adjustment. Both the float chamber and the lower tank are connected to the gas line at a point beyond that from which the gas sample is being collected.

When the gas sample has been collected in the upper tank, it is displaced therefrom by pumping water from the lower tank to the upper tank. The pipe leading from the discharge side of the pump to the upper tank is fitted with a bypass pipe returning to the lower tank, so that by adjustment of the valves on the two lines the gas in the upper tank can be displaced at any desired rate. This permits the delivery of this gas to the calorimeters.



Diagrammatic Drawing of Apparatus for Continuously Sampling Gas

EQUIPMENT NEWS *from* MAKER *and* USER

Torque Amplifier

The mechanical torque amplifier (Nieman patents) recently developed by the Bethlehem Steel Co., Bethlehem, Pa., is a mechanism provided with a control shaft at one end and a work shaft at the other, the control shaft requiring only a feeble torque to operate it in either direction, while the work shaft yields a torque of sufficient amount to accomplish any purpose desired, at the same time accurately following the control shaft in all its angular movements. Its broad purpose is to perform the functions of an electrical or hydraulic servo-motor, but so different are its operating characteristics that it should be considered as an entirely new type of control apparatus.

There are three elements to the torque amplifier: "work shaft," "control shaft" and "drive shaft." The drive shaft is driven by any outside source of power, such as an electric motor, and revolves continuously in one direction, a single motor being capable of operating a number of different amplifiers whose operation is entirely independent. The control shaft is actuated by any mechanical or manual control means, or by such weak forces as can be delivered through electrical recording instruments or telemetric transmission systems. The work shaft is directly coupled to the work to be done, as for instance the elevating or training gears of a gun, a ship's rudder or the steering wheel of an automobile. The control shaft can be freely revolved in either direction, with only a small amount of effort; the work shaft maintains at all times its angular syncronism with the control shaft, and in addition exerts a heavy torque to overcome outside resistance.

The lag between the work shaft and the control shaft is so small as to be inappreciable in any practical application. Measured in angle it never amounts to more than a degree or two of arc, and this is true even if the control shaft is actuated in the most erratic manner; that is, with sudden changes in speed and quick reversals of direction. The device has a definite maximum speed, depending on the speed of the drive shaft. If attempt is made to revolve the control shaft faster than this maximum speed, it will meet with a positive resistance which will hold its speed down to the maximum regardless of the torque applied.

There is always a definite ratio between the torque applied at the control shaft and that delivered at the work shaft, this ratio being known as the "amplification." This ratio may, however, be made as high as desired. In devices already constructed it ranges, according to the design, from 1 to 10 up to 1 to 50,000.

Fundamentally the torque amplifier consists of two oppositely rotating drums, provided with friction bands which may be brought into contact with the drums through actuation of the control shaft, this frictional contact causing the friction bands to exert pressure on the work shaft. The force applied to the control shaft is thus enhanced, or amplified, when it reaches the work shaft by the extent to which the bands are urged forward because of their frictional contact with the rotating drums.

In its simplest form the amplifier is shown in Fig. 1. Two oppositely rotating drums, *1*, *2*, are driven by a motor, not shown, through gears integral with the respective drums; *3* is the control shaft and *4* the work shaft. Fig. 2 is a section through Fig. 1 at the line shown and viewed in the direction of the arrows; while Fig. 3 is a longitudinal section through both drums. The control shaft *3* is concentric with work shaft *4* and is supported by a socket bearing in *4*. Integral with *3* is the forked control arm *5* which passes through a hole in the side of hollow shaft *4*, the size of this hole being sufficient for clearance and to allow a considerable angular movement of *3* in relation to *4*. Keyed to *4* is work arm *6* also forked. The friction bands *7* and *8* fit inside the drums *1* and *2*, respectively. These bands have sockets at each end, one socket of each band engaging with a stud on the work arm *6*, the socket at the other end of each band engaging with the respective ends of the control arm *5*. The bands are disposed in opposite directions in the two drums so that in each drum the band extends from the control arm around to the work arm in the direction of rotation of that drum. It follows that if the control arm is revolved in a given direction it will expand and tighten the band which lies in the drum rotating in the direction of the movement given to the control shaft, at the same time contracting and loosening the band in the opposite drum; therefore, the work arm, because of the frictional engagement of the band in one of the drums is pushed around by that band in the direction of the drum's rotation. Moreover the force with which the band presses against the work arm stud is many times the force applied at the control arm stud. This follows from the well known principle of wrapping friction, commonly used in calculating belt drives, snubbing problems, etc., and equally applicable to an outside band frictioning against the outside of a drum and an inside band frictioning against the inside of a drum. In the case of the amplifier shown we can assume a coefficient of friction of .6, an angle of wrap of a little less than a full circle, say six radians, giving a relation of about 40 to 1.

The action of the work arm in following the movements of the control arm can be understood from the following

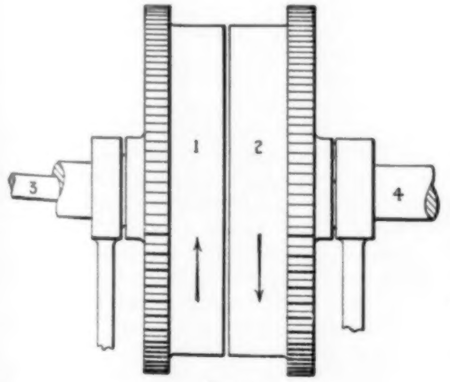


Fig. 1

Fig. 1—Out'ine Drawing of Torque Amplifier

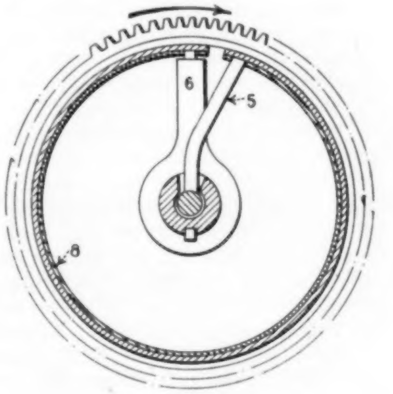


Fig. 2

Fig. 2—Transverse Section, Through Torque Amplifier on Center Line

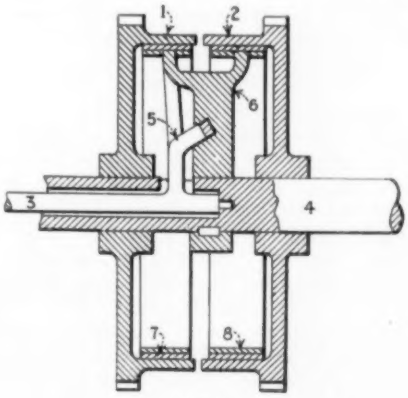


Fig. 3

Fig. 3—Longitudinal Section Through Torque Amplifier on Axis

consideration. Observing only drum *2* as shown in Fig. 2, if the control arm *5* is moved to the right by an infinitesimal amount, the band being originally barely in contact with the drum, is now put into frictional engagement with it. This forces the end of the work arm also to the right, the movement of the work arm in this direction tending to loosen the band, so that when the work arm has followed the control arm through exactly the same angle the band again reaches the condition of being barely in contact with the drum. If the movement of the control arm is a continuous one to the right then the work arm follows continuously so that the tape is always maintained in bare frictional contact with the drum. In the above it was assumed that the work arm moved with perfect freedom. If, however, the work shaft is doing external work it lags behind, thereby tightening the band until sufficient frictional contact is obtained to overcome the external resistance. The amount of such lag depends on the nature of the friction material. If a very spongy substance were used for this purpose, the angular lag would be considerable; but in the case of nearly incompressible friction materials it is so small as almost to escape detection. The difference between a band which slides freely within the drum and one which grips with a heavy friction is only a matter of .001 in. in radial expansion or about .006 in. expansion between the ends of the band. Special attention must be called to the fact that the speed of the drum has no relation to the speed of the band and connected parts except that the drum speed must always be higher than any speed at which it is desired to rotate the control shaft. In the normal operation of an amplifier the bands are intended to be in floating frictional engagement with the drums and never to grip them positively. The fact that the friction is of this floating type accounts for the fact that even with high drum speeds the control shaft may be revolved at a very slow speed while the work shaft executes the same slow movement with perfect uniformity. Such an amplifier as described above can be controlled in either direction, the torque furnished by the work shaft being always forty times that supplied by the control shaft, this "ratio of amplification" being theoretically constant for torques of any magnitude and practically so over a wide range.

A practical difficulty is encountered in constructing an apparatus as above described because of the necessity of accurately adjusting the lengths of the bands so that in reversing the direction of the control shaft the band on one side shall begin to grip just when the band on the other side releases. If the bands are made too long, both will be gripping at the same time where if too short there will be a neutral space when neither grips. To avoid this exceedingly close tolerance and alterations in service due to heating and wear, a floating automatic adjustment (the Lashlock) has been provided at the end of the work arm to keep both bands in light frictional contact under any conditions. Thus particular care is unnecessary to make both bands of exactly the same length. If one happens to be longer than the other it causes a slight angular displacement between the power and control arms, an error which being constant and always in the same direction automatically cancels out when the amplifier is initially set. If, after the mechanism is adjusted and calibrated, wear occurs in both bands equally, the backlash adjuster automatically takes it up without altering the adjustment.

For purposes where an amplification of 40 to 1 is not sufficient, the desired degree of amplification might be obtained by using a number of amplifiers in series, the work shaft of the first being connected to the control shaft of the second amplifier, and so on, the work shaft of the final amplifier performing the required work. Each amplifier in the series will multiply the torque it receives by 40. Thus, with two amplifiers the ratio of amplification would be 1 to 1,600; with three the ratio would be 1 to 64,000, etc. In actual design amplifiers are built in "stages," the first friction band contracting on the hub of a drum and the second expanding within the outer flange of the same drum; while the third band and the fourth contact similarly with a second drum. The bands are hooked together through a system of simple linkage.

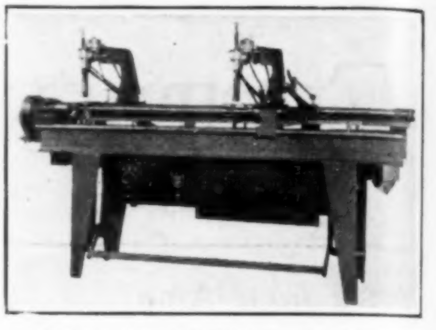
In amplifiers of certain types a spring may be used to perform the drive in one direction, either directly (in which case the torque on the work arm is limited, in that direction, to the strength of the spring) or by actuating the control of the final stage of a multi-stage amplifier (in which case the torque in both directions is unlimited).

Possible uses of the torque amplifier include such a range as automobile and ship steering, gun turning, train, switch and signal control, control of steam systems, running of tower clocks, operating valves, opening or revolving doors, metering devices, governors, spinning lathes, and regulation of roll speeds in steel, paper and textile mills.

Filling Device

The Vol-U-Meter Co., Inc., Buffalo, N. Y., are manufacturing a constant-weight filling device for filling drums, barrels or other containers, which can be installed on any beam scale.

This device is attached to the pipe line supplying the liquid and is provided with a nozzle which can be connected by a hose to the container being filled. The container is placed on the scale and weighed empty. A special net weight is placed on the end of the beam. Attached to the scale, operated by the beam is a small cut-off or pilot. When the drum is filled with the desired weight the beam rises and causes this cut-off, by means of a broken electrical contact, to operate the "Vol-U-Meter" and stop the flow.



Carbon Arc Butt Welding Machine

Butt Welder

A new design of automatic butt welding machine operating on the carbon arc process has been placed on the market by the Lincoln Electric Company, Cleveland, Ohio. This machine which is shown in the accompanying illustration is adapted to many types of work. For instance, it can be used for welding a plug into the end of a tube and, since it has two welding heads it can weld both ends of the tube at the same time. Another type of work to which it is adapted is the welding of small diameter round bars to large diameter bars.

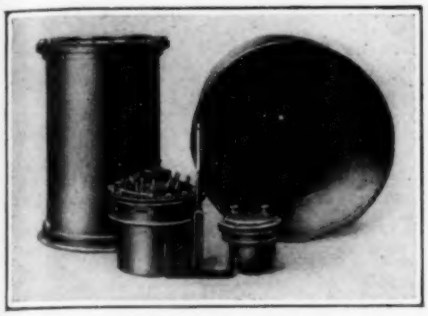
In this welder the welding heat is applied to the joint by the carbon arc and the work is revolved to distribute the heat uniformly. Pressure is applied to squeeze out the slag and obtain complete fusion. The motor-generator set used to supply current for the arc supplies direct current at 40 to 60 volts. The motor is a standard induction motor which does not take a special power rate.

Methane Detector

The Union Carbide & Carbon Corporation, in its research laboratories at Long Island City, has developed, under the guidance of E. K. Judd, a device for the detection of methane. This detector is based upon a platinum coil heated to a constant temperature. Such a heated coil becomes slightly hotter in the presence of methane, and the more methane present, the hotter it becomes. This coil, or filament, is about 1 in. long and 0.005 in. in diameter. It is secured at the end of a stick and connected to a portable storage battery which heats it to a constant temperature. The current from the battery is automatically maintained constant, so that any variation in the heat of the coil is caused by the combustion of methane at the surface of the wire.

The temperature of the coil is shown on a dial indicator, calibrated to register the amount of methane in the air around the coil. In order to prevent an explosion starting from the hot coil, it is protected by gauze bonnets. A concentration of 5 per cent methane, the danger point, causes the dial needle to swing rapidly back and forth.

This detector was developed for use in coal mines, where tests have shown it to be successful. Other uses may suggest themselves to those interested.



Vessels Constructed from Massive Haveg

Construction Material

Haveg, a material for the construction of chemical engineering apparatus, made by the Säureschutz Gesellschaft, m.b.H., Berlin-Alt-Glienicke, Germany, is made in several grades, depending upon the use to which it is to be put. The principal constituent of this material is Bakelite, to which a filler compound, largely asbestos, is added. The exact make-up of the filling compound is varied in order to give the finished material the desired qualities. In addition, a cold-hardening cement for acid construction, called "Havegit" is made.

Haveg is used as a primary, independent material for the construction of large apparatus. It is said to have met with much success in Germany. The simplest method of using this material consists in making the apparatus or parts entirely from Haveg which is done at high temperature and under high pressure, without any iron mantle or core. The illustration shows several cylindrical vessels made from this material alone. Such vessels are in use in many plants. They are rolled from one piece without seams and the bottom is attached to the side wall by a process resembling welding.

Apparatus of this type is made up to 2.6 m. inside diameter and 3 m. inside height. Up to 1 m. diameter the wall thickness is generally 10 to 15 mm.; for 1 to 1.6 m., 25 to 30 mm.; and for larger sizes, 35 to 40 mm. These wall thicknesses are sufficient even when a stirrer is used or when a steam jet is used for heating. The bottom should be 5 to 10 mm. thicker than the walls. Supports or connections can be attached to bottom or sides as desired.

One advantage of this construction is that the apparatus is able to withstand sudden changes in temperature of as much as 130 deg. C. As soon as a hot charge is emptied the vessel can immediately be filled with cold liquid.

Among other examples of equipment made are grating bars of the Raschig ring type for filling towers. Such gratings made of Haveg have been loaded to 10,000 kg. without failure. Thin walled drying trays have been made for drying iron-sensitive dyes and other chemically active products, the walls being 3 to 4 mm. thick. Such trays, if broken can be quickly and cheaply repaired. Other items made include pipe, filter press plates and frames.

The material, when used as a cover for metal plates in equipment manufacture, has a tendency to shrink and become loose from the plate. This is avoided by using perforated plates, the Haveg penetrating the perforations and becoming thus anchored in place. This can be done because the thickness is affected by the shrinking, but not the length.

In many designs of equipment strength is supplied to equipment of thin walled Haveg by supporting with a profile iron frame, there being no union between the two materials. In other cases the iron frame is fastened by screws to the Haveg body. In still other equipment, such as agitator paddles, an iron core is used, in which case the shrinking property of the material gives a firm bond. For stirring abrasive mixtures, stone ware disks can be imbedded in the Haveg on the pressure side to provide against wear.

Permeability Tester

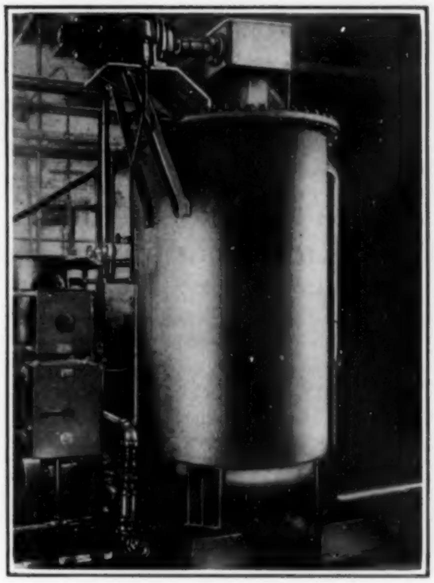
An instrument for testing the permeability of papers, fabrics, leather and other materials to liquids, called the "Penescope," is being made by Allen Abrams, Rothschild, Wis. It is used for testing sizing in paper; finding the time required for water, grease, acid or other liquid to penetrate materials; or determining the rate at which liquids penetrate into or through materials.

This device consists of a hollow brass chamber, having a plane machined surface on the outer rim; a hollow screw cap for holding the sample to be tested and ½-in. pipe connections above and below. The sample to be tested is placed in the lid, which is then screwed tightly against the chamber. Testing liquid is then introduced to the chamber.

Control Valve

Cochrane Corporation, Philadelphia, Pa., have developed a new single control valve for their pressure filters of the sand type. In such a filter there are ordinarily three pipes, one for raw water, one for filtered water and one for discharging washing water to waste. Valves are provided with cross connections so that the top of the filter can be connected either to receive water from the supply main or to discharge to waste, while the opening below the filter bed is connected to discharge water to the filtered water line or to receive water for back washing. This latter is sometimes filtered water and sometimes raw water. To carry out the necessary operations, five gate valves were formerly used.

The new valve which takes the place of these five valves is a plug valve of the multi-ported type. It is fitted with an indexed dial, so that an unskilled person can operate it correctly and rapidly. It is held to its seat by a spring and the pressure of the water on the unbalanced area of the conical plug further aids in holding it tight. Any difficulty in turning is obviated by a cam, which unseats the valve during turning.



Oil or Compound Cooler

Oil Cooler

The New York Engineering Co., 75 West St., New York, N. Y., is manufacturing, in various capacities, a new apparatus for cooling or congealing oil or compound such as is used for the impregnation of electric power cables.

In manufacturing cables, for example, paper is laid around the conductor and the whole is impregnated with a compound at 250 deg. F. After impregnation is complete the compound and cable are allowed to cool to the congealing point.

It is claimed by the makers that this new cooler cuts down the time of cooling by one-half and does the work more uniformly. It is provided with a scraper and agitator, to prevent oil or compound solidifying on the cooling surfaces, and to promote efficient heat exchange.

The cooling surfaces are arranged as three annular jackets through which the cooling water circulates. These jackets are separately piped, so that the time of cooling can be varied by cutting one or two of them out. Cooling may be performed with the whole system under a vacuum when desired.

It is said that this machine is useful in the cooling of other heavy, viscous liquids than impregnating compounds.

Gas Cutting Torch

Alexander Milburn Co., Baltimore, Md., have developed a torch for cutting metals with 4 in. water column pressure or more, using either natural or manufactured gas in combination with oxygen, in place of the usual oxy-acetylene flame. This torch is called the type LPG. It can be used with unscrubbed coke oven gas or with low B.t.u. gas when so desired. It is said to be economical in operation and to cut with a sharp, clean edge, devoid of slag on the underside and having a narrow kerf.

This torch is made of bronze forgings and seamless tubing. It is supplied with a range of tips.

Radiation Pyrometer

The "Pyro" radiation pyrometer, fully described in *Chem. & Met.* for August 4, 1924, is now being made and marketed in this country by The Pyrometer Instrument Co., 74 Reade St., New York, N. Y.

Metal Cutting

For users of Prest-O-Weld oxy-acetylene welding equipment who wish to do a limited amount of metal cutting, the Oxweld Acetylene Company, 30 East 42nd Street, New York City, has recently added to its line the CW-101 cutting attachment for its W-101 welding blowpipe. It is intended to handle occasional rather than regular cutting work, especially when the amount and nature of the work done does not warrant the purchase of a separate cutting outfit.

Fitted with two nozzles, this attachment will handle steel and wrought iron up to 1 or 1½ inch thickness. The oxygen pressures required for the CW-101 cutting attachment are practically the same as those in the Prest-O-Weld cutting table for C-101 cutting blowpipes. A table of pressure included in the instruction pamphlet furnished with the attachment simplifies the operator's work.

Conduit Fittings

The Crouse-Hinds Co., Syracuse, N. Y., has brought out a new line of "Obround" Condulets for which are claimed many improvements and time-saving features, based on a new method for fastening covers and wiring devices to a Condulet, known as the "Wedge-Nut" fastener.

With this new form of construction there are no screws projecting inwardly to interfere with the conductors. Because of the unobstructed cover opening conductors may easily be pulled through without injury to them, there being no projecting lugs. The unobstructed cover opening and large interior chamber are said to render splicing and taping easy.

Another new feature claimed for this design is that the covers and wiring devices may be conveniently installed even in difficult places, for the fittings may be turned so as to bring the fastening screws into an accessible position. Different types are available for all types of uses. One of these is illustrated in the accompanying photograph.

New Design of Conduit Fittings

Manufacturers' Latest Publications

Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.—A new illustrated descriptive catalog of floor operated electric hoists of the various types made by this company.

Lewis-Shepard Co., Watertown Station, Boston, Mass.—A new bulletin on material handling practices using "Jacklift" industrial trucks and stackers.

W. A. Jones Foundry & Machine Co., 4401 West Roosevelt Road, Chicago, Ill.—Catalog No. 26 (Second Edition)—New issue of general catalog of spur gear speed reducers.

Chrobaltic Tool Co., Detroit, Mich.—A new bulletin on heat resisting and special alloys.

H. H. Robertson Co., Pittsburgh, Pa.—Folder describing use of asbestos protected corrugated metal sheets for chemical plant construction.

Leeds & Northrup Co., Philadelphia, Pa.—Bulletin No. 660—Bulletin describing the Gibson system of automatic combustion control for boiler furnaces.

Lincoln Electric Co., Cleveland, Ohio—A booklet entitled "Modern Manufacturing with a 'Stable-Arc' Welder," describing the manufacture of machines and machine parts by welding.

New Departure Mfg. Co., Bristol, Conn.—Several new publications, as follows: Price list and specifications for single and double row ball bearings; Bulletin No. 178 FE, describing applications of ball bearings to homogenizers and multiple spindle drills; and a folder describing application of ball bearings to electric motors.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—Book S. P. 1774 and Leaflet L20319—The first describes mine and industrial electric locomotives and the second deals with the selection of electrical equipment for larry cars.

Semet-Solvay Engineering Corporation, 40 Rector St., New York, N. Y.—Pamphlets Nos. 310, 313 and 318—The first deals with byproduct equipment, the second with steel pipe and fittings and the third with water gas equipment.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin No. 1234—A catalog of the A-C vertical grinder for flour mills.

General Electric Co., Schenectady, N. Y.—New publications as follows: GEA-101A, dealing with station oil circuit breakers; GEA-151A, catalog of motor drives for rolling mills; GEA-706, dealing with station oil circuit breakers; GEA-722, dealing with "Selsyns" for distant signaling, control and indication; GEA-743, dealing with drum controllers for two- and three-phase slip-ring induction motors; GEA-763, catalog of isolated type induction motor panels; GEA-767, describing complete electric equipment for country grain elevators; GEA-780, dealing with solenoid-operated air circuit breakers; and PM-7162, a manual on the mechanical installation of electric motors and control.

Brown Instrument Co., Philadelphia, Pa.—Catalogs Nos. 45 and 75—The first is a catalog of electric tachometers and the second a catalog of recording pressure and vacuum gages.

Hercules Powder Co., Wilmington, Del.—A new catalog of turpentine, rosin, pine oils, terpene derivatives, nitrocellulose, pyroxylin paste and acids, all products of this company.

De Bothezat Impeller Co., Inc., 1922 Park Ave., New York, N. Y.—New general catalog of disk pressure fans and ventilating systems.

Crouse-Hinds Co., Syracuse, N. Y.—Bulletins Nos. G-2 and 308—The first deals with "Groundelets" and other safety circuit devices while the second describes floodlight projectors.

Alloys and Products, Inc., Oak Point Ave. and Barry St., New York, N. Y.—A series of bulletins on such metals and alloys as those of aluminum, copper, magnesium, manganese, bronzes, nickel, fluxing alloys and densifier alloys.

Ideal Concrete Machinery Co., Cincinnati, Ohio — Two bulletins describing various types of mixers and tumbling machinery.

Chicago Bridge & Iron Works, Chicago, Ill.—A bulletin describing the use of the Wiggins tank roof for the prevention of evaporation from liquids in storage.

Bailey Meter Co., Cleveland, Ohio—Bulletin No. 131—A bulletin describing a new design of electric fluid meter for measuring fluid flow.

Esterline-Angus Co., Indianapolis, Indiana—Folder describing use of instruments in maintenance work, including portable test sets.

Fawcus Machine Co., Pittsburgh, Pa.—Bulletin E—Catalog of worm gear drives for all purposes.

Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill.—Book No. 680—Catalog of bucket elevators with description of typical elevators for various purposes.

Warren Webster Co., Camden, N. J.—Bulletin No. 103—Catalog of feed water heaters made from genuine puddled wrought iron.

R. H. Beaumont Co., Philadelphia, Pa.—Catalog No. 95—Catalog of cable drag scrapers for handling sand, gravel, stone and other bulk materials.

Jeffrey Mfg. Co., Columbus, Ohio—Catalog Nos. 435 and 440—The first covers standard apron conveyors in wood and steel types and the second describes "Safeload" fans for forced draft and high pressure duties.

Downingtown Iron Works, Downingtown, Pa.—A booklet entitled "The Uses and Corrosion Resistant Properties of Chrome Iron," by T. Holland Nelson.

W. H. Nicholson & Co., Wilkes-Barre, Pa.—Bulletin No. 627—A bulletin describing all-metal, lubricated flexible couplings.

Hills-McCanna Co., 2025 Elston Ave., Chicago, Ill.—Folder describing various types of pumps for chemical plant service.

Combustion Engineering Co., 200 Madison Ave., New York, N. Y.—Reprint of an article by E. B. Severs describing the burning of pulverized lignite in the new Comal power plant in Texas.

Raymond Bros. Impact Pulverizer Co., 1315 N. Branch St., Chicago, Ill.—Bulletin on recent developments in Raymond pulverizing and air separating machinery.

Buffalo Forge Co., Buffalo, N. Y.—Catalog No. 422—New catalog of Buffalo Duplex and Turbo Conoidal fans.

Niagara Concrete Mixer Co., Buffalo, N. Y.—Folder describing the new Niagara Junior ball bearing vibrating screen.

Bailey Meter Co., Cleveland, Ohio—Bulletin 43A—Bulletin on the use of Bailey meters for increasing boiler efficiency.

Automatic & Electric Furnaces, Ltd., 173 Farringdon Road, London, E.C.1, England—Bulletin No. 38—A booklet entitled "The Correct Hardening of Tool Steel," by A. R. Page.

Linde Air Products Co., 30 East 42d St., New York, N. Y.—A bulletin describing various installations of long, oxwelded pipe lines.

The Dorr Co., 247 Park Ave., New York, N. Y.—Bulletin No. 4071—Bulletin describing the Dorr washer for concentrating iron ores and other similar materials.

Harmor & Co., Buffalo, N. Y.—Folder describing Harmor rotary driers.

Monarch Mfg. Works, Inc., Philadelphia, N. Y.—Catalog 6, Section C—Catalog of various types of spray nozzles for chemical plant use.

The Ruth Co., Denver, Colo.—Bulletin R-M12—New catalog of the Ruth rod mill for classified grinding.

Worthington Pump & Machinery Corporation, 115 Broadway, New York, N. Y.—Bulletin No. W-821—Bulletin describing the plant at Harrison, N. J., for the manufacture of water meters.

Mathieson Alkali Works, Inc., 250 Park Ave., New York, N. Y.—Bulletin No. 270—New publication on the uses and specifications of liquid caustic soda.

C. J. Tagliabue Mfg. Co., 18 Thirty-third St., Brooklyn, N. Y.—Bulletin No. 942—A catalog of the "Mono" gas analysis indicator-recorder for flue gases and of recording flue gas thermometers.

Botfield Refractories Co., Philadelphia, Pa.—Description of the "Adamant" gun for applying refractory coatings on fire brick.

Century Electric Co., St. Louis, Mo.—Form 653—Folder describing double squirrel-cage motors. Also Form 532, describing split phase motors.

Niagara Blower Co., Buffalo, N. Y.—A folder describing the blower installation in a slate-covered roofing plant.

Charles Engelhard, Inc., 30 Church St., New York, N. Y.—New bulletin on the type "S" recorder.

Taber Pump Co., Buffalo, N. Y.—Folder describing type "L" single suction centrifugal pumps from 15 to 2,000 gal. per min. capacity.

Bethlhem Foundry & Machine Co., Bethlehem, Pa.—Bulletin F-14—Description of the use of the Wedge furnace for revivifying fullers' earth.

Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill.—Bulletin B-3—Bulletin on the design and installation of "Clean Water" intake screens for condenser water.

American Blower Co., Detroit, Mich.—Bulletin announcing a new, smaller size of Venturafin unit heater, the No. 2.

PATENTS ISSUED

June 7 to July 5, 1927

Paper, Pulp and Sugar

Utilizing Wood Waste. Howard F. Weiss, Madison, Wis., assignor, by mesne assignments, to Wood Conversion Co., Cloquet, Minn.—1,631,171.

Utilizing Wood Waste. Howard Frederick Weiss, Madison, Wis., assignor, by mesne assignments, to Wood Conversion Co., Cloquet, Minn.—1,631,172.

Wall Board and Process of Making the Same. Howard F. Weiss, Madison, Wis., assignor, by mesne assignments, to Wood Conversion Co., Cloquet, Minn.—1,631,173.

Product Obtained from Molasses and Process of Preparing Same. Walter H. Dickerson, East Orange, N. J., assignor to Industrial Waste Products Corporation, Dover, Del.—1,631,252.

Paper Product and Method of Making Same. James McIntosh, Norristown, Pa., assignor to Diamond State Fibre Co., Bridgeport, Pa.—1,631,750.

Method and Apparatus for Mixing Pulp. Waldo E. Rosebush, Millwood, Wash., assignor to Inland Empire Paper Co., Millwood, Wash.—1,631,762.

Manufacture of Paper Pulp. James Brookes Beveridge, Richmond, Va.—1,631,789.

Exhaust System for Paper-Machine Driers. Waldo E. Rosebush, Millwood, Wash.—1,631,833.

Gelatinizing Wood. Arlie William Schorger, Madison, Wis., assignor, by mesne assignments, to Wood Conversion Co., Cloquet, Minn.—1,631,834.

Process and Apparatus for Making Pulp from Fibrous Material. Frederick K. Fish, Jr., San Francisco, Calif.—1,632,467.

Apparatus for Cooking Pulp. Carlton H. Allen, Glens Falls, N. Y., assignor of one-half to Great Northern Paper Co., Millinocket, Me.—1,632,779.

Apparatus for Treating Pulp. Carlton H. Allen, Millinocket, Me., assignor of one-half to Great Northern Paper Co., Millinocket, Me.—1,633,553.

Pulp-Cooking Apparatus. Carlton H. Allen, Dayton, Ohio, assignor of one-half to Great Northern Paper Co., Minninocket, Me.—1,633,554.

Retted Bagasse Fiber and Process of Producing Same. Elbert C. Lathrop, Philadelphia, Pa., and Treadway B. Munroe, Forest Glen, Md., assignors, by direct and mesne assignments, to Dahlberg & Co., Inc., Chicago, Ill.—1,633,594.

Apparatus and Process for Making Paper Pulp. Frederick K. Fish, Jr., San Francisco, Calif.—1,633,730.

Process for Treating Plant Material. Frederick K. Fish, Jr., San Francisco, Calif. —1,633,731.

Process and Apparatus for Making Pulp from Fibrous Material. Frederick K. Fish, Jr., San Francisco, Calif.—1,633,732.

Process and Apparatus for Digesting or Cooking Fibrous Material. Frederick K. Fish, Jr., San Francisco, Calif.—1,633,734.

Process and Apparatus for Making Pulp from Fibrous Material. Frederick Knapp Fish, Jr., San Francisco, Calif.—1,633,735.

Process of Preparing Paper Pulp. Frederick Knapp Fish, Jr., San Francisco, Calif. —1,633,736.

Liquor for Treating Plant Material and Process of Producing the Same. Frederick Knapp Fish, Jr., San Francisco, Calif.—1,633,737.

Method of and Apparatus for Controlling the Moisture Content of Paper. Frank E. P. Klages, Chicago, Ill., assignor to The Powers Regulator Co., Chicago, Ill.—1,633,817.

Process of Making Paper from Straw and Product. Charles D. Wood, Cleveland, Ohio, assignor to The Grasselli Chemical Co., Cleveland, Ohio.—1,634,603.

Rubber and Synthetic Plastics

Cellulose-Acetate Composition of Low Inflammability. Stewart J. Carroll, Rochester, N. Y., assignor to Eastman Kodak Co., Rochester, N. Y.—1,631,468.

Waterproof Cementing Composition. Gustave F. Dreher, Schenectady, N. Y., assignor to General Electric Co.—1,631,671.

Vulcanizing Method and Apparatus. James D. Tew, Hudson, Ohio, assignor to The B. F. Goodrich Co., New York, N. Y.—1,631,707.

Process of Surface-Finishing Rubber Goods and Product of Same. Herbert W. Emery, Holliston, Mass., assignor to Archer Rubber Co., Milford, Mass.—1,631,722.

Vulcanizing Apparatus. Roy D. Fritz, Akron, Ohio, assignor to The B. F. Goodrich Co., New York, N. Y.—1,631,806.

Manufacture of Artificial Silk. Friedrich Wilhelm Schubert, Apperley Bridge, near Bradford, England, assignor to Brysilka, Limited, Apperley Bridge, near Bradford, England.—1,631,835.

Method of Treating Rubber Articles. William R. Urquhart, Los Angeles, Calif., Clifford W. Post, Chicago, Ill., Dwight E. Humphrey, Cuyahoga Falls, Ohio, and Clarence C. Van Arsdale, Akron, Ohio, assignors to The Goodyear Tire & Rubber Co., Akron, Ohio.—1,631,943.

Method of Treating Rubber. Herman A. Bruson, Akron, Ohio, assignor to The Goodyear Tire & Rubber Co., Akron, Ohio, —1,631,947.

Phenolic Condensation Product. Arthur L. Brown, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Co.—1,632,113.

Manufacture of Molded Articles from Latex. Chauncey C. Loomis, Yonkers, and Horace E. Stump, Brooklyn, N. Y., assignors, by mesne assignments, to The Hevea Corporation.—1,634,293.

Rubber Vulcanization and Products Thereof. Stuart B. Malony, Conshohocken, Pa., and Yasujuro Nikaido, Bay City, Mich., assignors, by mesne assignments, to Charles W. Brown, William L. Clause, and Edward Pitcairn, Pittsburgh, Pa.—1,632,617.

Rubber Vulvanization and Products Thereof. Stuart B. Molony, Wellesley Hills, Mass., and Yasujuro Nikaido, Bay City, Mich., assignors, by mesne assignments, to Charles W. Brown, William L. Clause, and Edward Pitcairn, Pittsburgh, Pa.—1,632,666.

Process for Treating Rubber Latex. Ernest Hopkinson, New York, and Willis A. Gibbons, Little Neck, N. Y.; said Gibbons assignor to The Naugatuck Chemical Co., Naugatuck, Conn.—1,632,759.

Fireproofed Product and the Production Thereof. Charles E. Burke, Wilmington, Del., assignor, by mesne assignments, to Du Pont Viscoloid Co., Wilmington, Del.—1,633,067.

Resinous Reaction Product of Urea and Formaldehyde. Felix Lauter, Philadelphia, Pa., assignor to Rohm & Haas Co.—1,633,337.

Method of Thickening and Stabilizing Latex and Product. Merwyn C. Teague, Jackson Heights, N. Y., assignor to American Rubber Co., East Cambridge, Mass.—1,634,124.

Rubber-Vulcanization Process. Clayton Olin North, Akron, Ohio, assignor to The Rubber Service Laboratories Co., Akron, Ohio.—1,634,336.

Accelerator for the Vulcanization of Rubber. George Stafford Whitby, Montreal, Quebec, Canada, assignor to The Roessler & Hasslacher Chemical Co., New York, N. Y. —1,634,924.

Accelerator for the Vulcanization of Rubber. George Stafford Whitby, Montreal, Quebec, Canada, assignor to The Roessler & Hasslacher Chemical Co., New York, N. Y. —1,634,925.

Ester-Resin Composition and Method of Preparation. James G. E. Wright, Alpaus, N. Y., and Willard J. Bartlett, East Cleveland, Ohio, assignors to General Electric Co.—1,634,969.

Manufacture and Production of Threads, Filaments, Strips, or Films from Cellulose Esters. Louis Clément and Cléry Rivière, Pantin, France, assignors of one-half to Courtaulds, Limited, London, England.—1,634,980.

Process of Treating Celluloise Acetate. Edward S. Farrow, Jr., Rochester, N. Y., assignor to Eastman Kodak Co., Rochester, N. Y.—1,634,986.

Cellulose Acetate and Process of Making the Same. Richard Baybutt and Edward S. Farrow, Jr., Rochester, N. Y., assignors to Eastman Kodak Co., Rochester, N. Y.—1,635,026.

Petroleum Refining

Process of Making Motor Fuel. Roy Cross, Kansas City, Mo., assignor to Gasoline Products Co., Inc., New York, N. Y.—1,631,401.

Production of Petrol. Frank Tinker, Sutton Coldfield England.—1,632,011.

Process for Producing Light Hydro-Carbon Liquids. Eugene C. Herthel, Chicago, Ill., assignor to Sinclair Refining Co., New York, N. Y.—1,632,967.

Method of Revivifying Spent Adsorbents for Oil Treatments. Paul W. Putzman, Los Angeles, Calif., assignor, by mesne assignments, to Contact Filtration Co., San Francisco, Calif.—1,633,871.

Cracking of Hydrocarbons. Eugene C. Herthel and Harry L. Pelzer, Chicago, Ill., assignors to Sinclair Refining Co., Chicago, Ill.—1,634,666.

Inorganic Processes

Process for the Manufacture of Sulphuric Acid. Eldon L. Larison, Anaconda, Mont. —1,631,139.

Process for the Manufacture of Chromium Compounds. Paul Weise, Wiesdorf, near Cologne-on-the-Rhine, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,631,170.

Ceramic Insulating Material. Joseph A. Jeffery and Earle T. Montgomery, Detroit, Mich., assignors by mesne assignments, to Champion Porcelain Co., Detroit, Mich.—1,631,729.

Ceramic Material. Joseph A. Jeffery and Earle T. Montgomery, Detroit, Mich., assignors, by mesne assignments, to Champion Porcelain Co., Detroit, Mich.—1,631,730.

Process for the Preparation of Magnesium Chromates. Georg Kränzlein and Arthur Voss, Hochst-on-the-Main, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.—1,632,299.

Manufacture of Hypochlorites. Robert Burns MacMullin, Niagara Falls, N. Y., assignor to The Mathieson Alkali Works, New York, N. Y.—1,632,483.

Process of Purifying Alkali-Metal Cyanide Solutions Containing Sulphides. Kurt Herrdegen, Ludwigshafen-on-the-Rhine, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,633,485.

Method of Preparing Satin White. John F. Fredriksson, Brooklyn, N. Y., assignor to The Kalbfleisch Corporation, New York, N. Y.—1,632,891.

Treatment of Lime Nitrogen. Job Morten August Stillesen, Niagara Falls, N. Y.—1,633,200.

Process of Refining Barytes. William J. O'Brien, Baltimore, Md.—1,633,347.

Heavy Metal Mercapto Sulphonic Compounds. Adolf Feldt, Berlin-Wilmersdorf, Walter Schoeller, Berlin-Westend, and Erich Borgwardt, Berlin, Germany, assignors to Chemische-Fabrik auf Actien (vorm. E. Schering), Berlin, Germany.—1,633,626.

Method of Making Precipitated Antimony Sulphide. Rawson E. Stark, Elyria, Ohio, assignor to The Stibium Products Co., Elyria, Ohio.—1,633,754.

Heat-Resisting Alloy. Gerald R. Brophy, Schenectady, N. Y., assignor to General Electric Co.—1,633,805.

Aluminum-Chloride Production. Edson R. Wolcott, Los Angeles, Calif., assignor, by mesne assignments, to The Texas Co., New York, N. Y.—1,633,835.

Process of Recovering Hydrochloric Acid. Henri Terrisse and Marcel Levy, Geneva, Switzerland.—1,633,877.

Producing Lead Compounds of Chromic Acids. Alexander Nathansohn, Bad Harzburg, Germany.—1,633,948.

Method of Producing Sodium Fluoride. Earl P. Stevenson, Newton, Mass., assignor to Arthur D. Little, Inc., Cambridge, Mass. —1,634,122.

Colorless Crookes Glass. Philip Victor, Willingham Gell, Charles Edwin Gould, Wilfred Marsh Hampton, and Harold Sharpe Martin, Smethwick, England, assignors to Chance Brothers and Co., Limited, Smethwick, England.—1,634,182.

Oxychloride Cement and Process of Making Same. William J. McCaughey, Columbus, Ohio, assignor to The Cleveland Trust Co., Cleveland, Ohio.—1,634,505.

Process of Continuously Producing Phosphorus Nitride and Certain Halides from Raw Materials. Claude G. Miner, Berkeley, Calif.—1,634,796.

Process for the Production of Ammonium Chloride and Alkali-Metal Sulphate. Otto Gerngross, Gunewald, near Berlin, Germany, assignor to the Firm Continentale Aktiengesellschaft für Chemie, Berlin, Germany.—1,634,870.

Glass Composition. Warren F. Bleecker, Boulder, Colo.—1,629,648.

Process of Drying and Calcining Lithopone. Walter G. Graves, Cleveland, Ohio, assignor to The Grasselli Chemical Company, Cleveland, Ohio.—1,630,613.

Organic Processes

Sulphur-Black Dye. Otto Zeller, East Aurora, and Clemens Waldman, Buffalo, N. Y., assignors to National Aniline & Chemical Company, Inc., New York, N. Y. —1,630,818.

Coal-Mining Explosive. Walter O. Snelling, Allentown, Pa., assignor to Trojan Powder Company, New York, N. Y.—1,631,070.

Process for the Reduction of Halogenated Hydrocarbons. Alfred Felix Sebastien Bellone, Lyon, France, assignor to Societe Chimique des Usines du Rhone, Paris, France.—1,627,881.

Process for Preparing Nitriles of the Benzanthrone Series. Maximilian Paul Schmidt and Wilhelm Neugebauer, Biebrich-on-the-Rhine, Germany, assignors, by mesne assignments, to Grasselli Dyestuff Corporation, New York, N. Y.—1,628,280.

Process for the Manufacture of Sodium Azide. Frank Wilcoxon, Ithaca, N. Y., and Bennett Grotta, Tamaqua, Pa., assignors to Atlas Powder Company, Wilmington, Del.—1,628,380.

Indophenol and Process of Producing the Same. Joseph G. Dinwiddie, Penns Grove, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,628,534.

Manufacturing Menthol. Karl Schöllkopf, Dusseldorf-Oberkassel, Germany, assignor to Rheinische Kampfer-Fabrik Gesellschaft mit beschränkter Haftung, Dusseldorf-Obercassel, Germany.—1,629,002.

Process for Manufacturing Dihydroxy Perylene. Alois Zinke and Albert Klingler, Graz, Austria, assignors, by mesne assignments, to Felice Bensa.—1,629,194.

Method of Producing Activated Carbonaceous Substances and the Product of the Method. Edgar Rouse Sutcliffe, Leigh, England.—1,629,237.

Process of Obtaining Glue and Gelatin. George R. Underwood, Peabody, Mass., assignor to American Glue Company, Boston, Mass.—1,629,556.

Propellant Powder. John M. Olin and Arthur S. O'Neil, Alton, Ill., assignors to Western Cartridge Company, East Alton, Ill.—1,627,859.

Acridine Derivatives and Process of Making Same. Heinrich Jensch, Hochst-on-the-Main, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,629,873.

Triaryl - Methane Dyes from Tetraalkyl-Diamino-Benzophenone and Arylated-Ethylene-Diamines. Heinrich Polikier, Leipzig, and Herbert Hähle, Dessau-Ziebigk, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,629,884.

Stable Diazo Compound and Process of Making Same. Guillaume de Montmollin and Gérald Bonhôte, Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basel, Switzerland.—1,629,906.

Low-Viscosity Lacquer and Film Produced Therefrom. Edmund M. Flaherty, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del. —1,629,999.

Process for the Manufacture of Urea from Cyanamide. Joseph Breslauer and Charles Goudet, Geneva, Switzerland, assignors to Société d'Etudes Chimiques pour l'Industrie, Geneva, Switzerland, a company of Switzerland.—1,630,050.

Manufacture of Mercuri-Mononitro-Ortho-Cresol and Its Salts. George W. Raiziss, Philadelphia, Pa., assignor to The Abbott Laboratories, Chicago, Ill.—1,630,072.

Nitroglucoside Explosive. Robert C. Moran, Woodbury, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,630,577.

Process of Making Esters from Aldehydes. Charles O. Young, Jackson Heights, N. Y., assignor to Carbide & Carbon Chemicals Corporation.—1,630,593.

Dye Composition. Joseph Merritt Matthews, New York, N. Y., assignor to Glorient, Inc., New York, N. Y.—1,630,624.

Process of Making Disubstituted Guanidines. Winfield Scott, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,630,769.

Process and Apparatus for Producing Hexamethylenetetramine and Ammonium Chloride. Carnie B. Carter, deceased, Pittsburgh, Pa., by Myrtice G. Carter, executrix, Pittsburgh, Pa., assignor to S. Karpen & Bros., Chicago, Ill.—1,630,782.

Manufacture of Products from Aromatic Amines and Sulphur Chloride. Joseph V. Meigs, Montclair, N. J., assignor, by mesne assignments, to Carlton Ellis, Montclair, N. J.—1,631,280.

Refrigerant. George Barsky, New York, N. Y., assignor to American Cyanamid Co., New York, N. Y.—1,631,573.

Anthraquinone Paste and Method of Making the Same. William M. Grosvenor and Victor P. Gershon, New York, N. Y.; said Gershon assignor to said Grosvenor.—1,631,489.

Process of Recovering Ammonia from Gases Containing Same. Royall O. E. Davis, Chapel Hill, N. C., and Lewis B. Olmstead, Peru, Nebr.—1,631,720.

Violet Vat Dyestuff of the 2-Thionaphthene-2-Indolindigo Series. Richard Herz, Frankfort-on-the-Main, Germany, assignor to Grasselli Dyestuff Corporation, New York, N. Y.—1,631,865.

Process of Manufacturing Mercapto-Benzo-Thiazole. William J. Kelly, Akron, Ohio, assignor to The Goodyear Tire & Rubber Co., Akron, Ohio.—1,631,871.

Manufacture of Stabilized Metal-Dehyde. Emil Lüscher, Basel, Switzerland, assignor to The Society Elektrizitätswerk Lonza, Gampel and Basel, Switzerland.—1,631,875.

Phosphorus Containing Nuclear Substance of Milk Casein in a Chemically-Pure Form and Process of Making the Same. Swigel Posternak, Chene-Bougeries, near Geneva, Switzerland, assignor to Society of Chemical Industry in Basle, Basel, Switzerland.—1,631,887.

Method for Removing Tetranitromethane from Trinitrotoluene. Richard Hans Gärtner, Hamburg, Germany.—1,632,959.

Production of Benzidine and Derivatives. Ralph A. Nelson, Buffalo, N. Y., assignor to National Aniline & Chemical Co., Inc., New York, N. Y.—1,633,123.

Process for Reducing the Viscosity of Nitrocellulose and Other Celulose Esters. Stanley De Vries Shipley, Stamford, Conn., assignor to Atlas Powder Co., Wilmington, Del.—1,633,292.

Cellulose-Ester Composition. George L. Schwartz, Wilmington, Del., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del.—1,633,683.

Manufacture of Condensation Products and Dyestuffs of the Benzanthrone Series. Arthur Lüttringhaus, Mannheim, Heinrich Neresheimer, Ludwigshafen-on-the-Rhine, and Hugo Wolff, Mannheim, Germany, assignors to I. G. Farbenindustries Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,633,866.

Chromable Azodyestuffs Derived from Formaldehyde Sulphurous Acid and Nitrated 1 - (Azo-Naphthol) - 2 - Hydroxy-Naphthalene-4-Sulphonic Acid and Process of Making Same. Fritz Straub, Basel, and Hermann Schneider, Riehen, near Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basel, Switzerland.—1,633,874.

Ether of Polyolefin Glycol and Process for Making the Same. Joseph G. Davidson, Yonkers, N. Y., assignor to Carbide & Carbon Chemicals Corporation.—1,633,927.

Omega - Aminoalkyl - Aminonaphthalenes. Walter Duisberg, Leverkusen, near Cologne, and Winfrid Hentrich, Ludwig Zeh, and Johann Huismann, Wiesdorf, near Cologne, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.—1,633,929.

Manufacture of Vat Dyestuffs. Paul Nawiasky, Ludwigshafen - on - the - Rhine, Karl Zahn, Hochst-on-the-Main, and Karl Sturwein, Ludwigshafen-on-the-Rhine, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the Main, Germany.—1,633,997.

Di-Acylacetyl-Arylenediamine and Process of Making Same. Arthur Zitscher and Robert Schmitt, Offenbach-on-the-Main, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,634,090.

Manufacture of Beataine Hydro-Chloride etc. Donald K. Tressler, Pittsburgh, Pa., assignor to Larrowe Construction Co., Detroit, Mich.—1,634,221.

Process of Making N-Dihydro-1-2-2′-1′-Anthraquinoneazine. Lynne H. Ulich, Racine, and Robert J. Goodrich, South Milwaukee Wis. assignors to The Newport Co., Milwaukee, Wis.—1,634,473.

Process for Production of Hydrocyanic Acid. Georg Bredig and Egon Elöd, Karlsruhe, Germany.—1,634,735.

Manufacture of Pectin Products. Dinshaw Rattonji Nanji, Birmingham, and Frederic James Paton, Smethwick, England.—1,634,879.

Process of Drying Alkali Cellulose. Paul C. Seel, Rochester, N. Y., assignor to Eastman Kodak Co., Rochester, N. Y.—1,635,012.

Process for Reducing the Viscosity Characteristics of Cellulose Ethers. Paul C. Seel, Rochester, N. Y., assignor to Eastman Kodak Co., Rochester, N. Y.—1,635,013.

Chemical Engineering Equipment and Processes

Vertical Film-Type Evaporator. Leslie Earl Sebald, Ridgewood, N. J., assignor to The Griscom-Russell Co., New York, N. Y. —1,631,162.

Method and Apparatus for Determining Equilibrium Vaporization End Point. Charles E. Parsons, Englewood, N. J., and Reston Stevenson, New York, N. Y., assignors to William P. Deppe, New York, N. Y.—1,632,748.

Flow-Controlling Apparatus. Carlton H. Allen, Dayton, Ohio, assignor of one-half to Great Northern Paper Co., Millinocket, Me. —1,632,780.

Agitator. Roland E. Minogue, Manitowoc, Wis., assignor of one-third to Henry Vanderverp, Manitowoc, Wis.—1,633,708.

Tunnel Kiln. Halver R. Straight, Adel, Iowa.—1,633,829.

Process for Treating Liquids. Cornelius Lourens, Amsterdam, Netherlands, assignor to Naamlooze Vennootschap Algemeine Norit Maatschappij, known as General Norit Co., Limited, Amsterdam, Netherlands.—1,634,154.

Method and Mechanism for Removing Centrifuge Effluents. Leo D. Jones, Philadelphia, Pa., assignor to The Sharples Specialty Co., Philadelphia, Pa.—1,634,242.

Flotation Separating Process. Everett A. Hall and George R. Sanders, Joplin, Mo., assignors to Southwestern Engineering Corporation, Los Angeles, Calif.—1,634,615.

Spray Processing Apparatus. Paul T. Zizinia, Belmar, N. J., assignor to Industrial Spray-Drying Corporation, New York, N. Y.—1,634,640.

Brake-Actuating Mechanism for Centrifugal Machines. William Colclough, Norwood, Ohio, assignor to The American Laundry Machinery Co., Cincinnati, Ohio.—1,634,651.

Overdriven Extractor. Emil J. Carroll, Cincinnati, Ohio, assignor to The American Laundry Machinery Co., Cincinnati, Ohio.—1,634,707.

Apparatus for Precipitating and Filtering. Louis D. Mills, Redwood City, and Thomas B. Crowe, Palo Alto, Calif., assignors to The Merrill Co., San Francisco, Calif.—1,634,720.

Centrifugal Drier. Guy H. Elmore, Swarthmore, Pa.—1,634,868.

Drier. Richard Reed Morrill, Palo Alto, Calif., assignor by mesne assignments, to Oliver Oil-Gas Burner and Machine Co., St. Louis, Mo.—1,634,882.

Apparatus for Delivering Measured Quantities of a Fluent Material. Bohumil Jirotka, Berlin, Germany, assignor to the Firm Dr. Otto Sprenger, Patentverwertung Jirotka mit beschränkter Haftung, Vaduz, Germany—1,635,126.

Apparatus for Grading Sand and Grinding Glass. James W. Cruikshank, Pittsburgh, Pa., assignor to J. W. Cruikshank Engineering Co., Pittsburgh, Pa.—1,634,254.

Process of Making Precipitated Barium Carbonate and Barium Sulphydrate. James B. Pierce, Jr., Charleston, W. Va.—1,634,338.

Method of and Apparatus for Quantitative Determination of Gas. Roscoe P. Mase, Wilkinsburg, Pa.—1,634,331.

Controller for Power-operated Machines. Frederick H. Oberschmidt, Cleveland, Ohio, assignor to The Cutler-Hammer Mfg. Co., Milwaukee, Wis.—1,634,382.

Method of Producing Improved Lime Hydrate. William K. Hunter, Knoxville, Tenn. assignor of one-half to Marion F. Nichols, Knoxville, Tenn.—1,634,424.

Extractor Control. Emil J. Carroll, Cincinnati, Ohio, assignor to The American Laundry Machinery Co., Cincinnati, Ohio.—1,634,452.

Process for Making Decolorizing Carbon. Leonard Wickenden, Flushing, N. Y., and Stanley A. W. Okell, Tyrone, Pa., assignors to Industrial Chemical Co., New York, N. Y. —1,634,477.

Process and Apparatus for Making Decolorizing Carbon. Leonard Wickenden, Flushing, N. Y., and Stanley A. W. Okell, Tyrone, Pa., assignors to Industrial Chemical Co., New York, N. Y.—1,634,478.

Electric-Furnace Apparatus and Process of Revivifying Decolorizing Carbon, etc. Leonard Wickenden, Flushing, and Walter F. Demmerle, New York, N. Y., assignors to Industrial Chemical Co., New York, N. Y.—1,634,479.

Electric-Furnace Apparatus and Process for Making Decolorizing Carbon. Leonard Wickenden, Flushing, N. Y., and Stanley A. W. Okell, Tyrone, Pa., assignors to Industrial Chemical Co., New York, N. Y.—1,634,480.

Process of Preparing an Adsorbent for Oils. Wirt D. Rial and Earle W. Gard, Wilmington, Calif.—1,634,514.

Combustion System. Arthur J. Boynton, Wilmette, Ill., assignor, by mesne assignments, to Victor Chemical Works, Chicago, Ill.—1,634,570.

Liquid-Measuring Attachment for Tanks. John E. Boegen, Los Angeles, Calif., assignor to Boegen Gauge Co., Inc., Los Angeles, Calif.—1,634,608.

NEWS of the Industry

Tariff Commission Conducts Ten Investigations

STARTING this month the U. S. Tariff Commission will carry out field work in ten new cost of production investigations and one survey, it was announced orally by the Commission June 30. These investigations were ordered during May, but lack of funds caused some delay in getting the necessary specialists.

In addition to its cost inquiries in the domestic markets, the Commission through its own channels will obtain similar information from producers abroad.

The manganese ores inquiry will be virtually a survey of the industry in this country and abroad. This inquiry was also touched upon by the Commission in its announcement.

The full text of the Commission's announcement follows:

Sodium Phosphate — Dexter North, Mark A. Smith, Lewis Baillif. To visit Massachusetts, New York, Ohio, Illinois and Alabama.

Whiting — M. G. Donk, Mark A. Smith, William G. Diddicock. To visit Pennsylvania, New Jersey and Massachusetts.

Potassium Permanganate — Dexter North, Mark A. Smith, and Lewis Baillif. To visit Illinois, and other points, if necessary.

Perfume and Toilet Bottles—A. M. Fox, Kenneth Stone, Miss Mary Richey. To visit Maryland, New York, New Jersey, Illinois.

Window Glass—J. Mark Albinson, Oscar Ryder, M. R. Greigg, R. F. Clourine, and R. E. Needs, and A. L. Morgan, New York, Pennsylvania, West Virginia, Ohio, Indiana, Arkansas, Kansas, Louisiana, Illinois and Wyoming.

Imitation Pearls and Pearl Beads—A. M. Fox, Charles F. Touch, H. F. Burket and Kenneth Stone.

Fresh tomatoes—No assignments.

Canned tomatoes—No assignments.

Corn—No assignments.

Flaxseed—No assignments.

With regard to these latter investigations, the Commission has not concluded its plans of investigation. These will be announced later by the Commission.

In connection with the Commission's investigation covering manganese ores, and its products, which is to be conducted under its general powers, Paul M. Tyler, V. C. Woolley and N. J. Halpin have been selected to do the field work. This inquiry will involve both a cost and economic study of these ores in this country and abroad. They are to make a survey of the producing and consumption points of the ores in the States of New York, Pennsylvania, Maryland, Minnesota, Montana, New Mexico and Arizona.

Morehead Medals Awarded To Fouché and Davis

M. EDMOND FOUCHE, of Paris, and Augustine Davis, of New York City were honored by the International Acetylene Association through the award to them of the first two replicas of the Morehead medal. Presentation occurred at a banquet held June 21 in New York City in recognition of the outstanding contributions of these two men to the foundation of the acetylene business. The president, W. A. Slack, of Chicago, acting as toastmaster, called upon E. L. Davis to present the medal for M. Fouché, and this medal was received in his behalf by the Consul General of France stationed in New York City. This award was a recognition of the fact that Fouché had developed the first successful method for oxy-acetylene cutting and welding through the design of a workable oxy-acetylene torch.

Augustine Davis was present in person to receive his medal, which was presented by A. Cressy Morrison, secretary of the association. In presenting the medal the early history of the industry in which Mr. Davis has had part from its very inception was recounted, particular emphasis being given to Mr. Davis' contribution to the design of the medium pressure acetylene generator and of many accessory units which have been at the foundation of generator practice in the United States for over thirty years. Mr. Davis' work included bringing to the United States the first Fouché torches which were then developed further and adapted to American uses by Mr. Davis.

This medal, which will be awarded annually by the International Acetylene Association, has been founded by gift from John M. Morehead in honor of his father, James T. Morehead, who was associated with Willson in the experiments which attempted to make metallic calcium, but which resulted in the first industrial manufacture of calcium carbide.

Consolidation of Chromium Interests Effected

THROUGH the affiliation of the General Chromium Corporation, the Vacuum Can Co. and the interested subsidiaries of the Union Carbide and Carbon Corporation, there has been formed a new General Chromium Corporation to take over the chromium plating business of this group of interests. Research work of the new corporation will be continued in the laboratories of the affiliated interests at Niagara Falls, Chicago and Long Island City; and the commercial plating work will be done at the plant located near Detroit. The work of this corporation will be marketed with the trade designation, "Duro-chrome." The management of the new corporation will be under a board of directors including B. O'Shea and F. M. Becket of the Carbide corporation, F. J. Fisher of the General Motors Co., A. E. Baldwin and Horace Maynard of the old General Chromium Corporation, and B. O. Smith and Roy Gleason of the Vacuum Can Co.

Plans for Enforcement of Caustic Poison Act

REGULATIONS for the enforcement of the Caustic Poison Act, which will go into effect on September 4, are being worked out by the new Food, Drug and Insecticide Administration. Among the poisons are preparations containing carbolic acid, ammonia caustic soda and lye, and others.

The act is designed to safeguard the distribution and sale of certain dangerous caustic or corrosive acids, alkalies, and other substances in interstate and foreign commerce. It requires that such substances be labeled poison and that there be placed on the label an antidote for accidental poisoning.

Ceramic Society Sponsors Foreign Trip

The American Ceramic Society is arranging a foreign tour which will be built around ceramic centers in European countries. According to present plans the members will meet in Montreal on May 19, 1928, and sail from that city on the following day. The itinerary includes visits to Scotland, England, Holland, Germany and France.

First Institute of Chemistry Meets at State College

Progress in Study of Chemistry Is Combined With Vacation Features—Meetings to Continue Over the Month

By Special Correspondence

THE FIRST Institute of Chemistry, held at State College, Pa., this month, represents an experiment on the part of the American Chemical Society in providing for its members and to some extent for the general public a session of a sort quite different from the regular meetings. A wide audience has been sought; not only the students, teachers, and industrial men present at the Institute, but through the press and the radio all those who are interested in what chemists are doing and what chemistry is accomplishing. And so far, the experiment seems to be a thorough success; at least, if the unanimous and enthusiastic approval of all the members is a criterion.

The group of about one hundred which forms the nucleus of the Institute represents a wide geographical distribution: California, Florida, Porto Rico, Nova Scotia, China, England, and Germany; and yet the joys and sorrows of fraternity life at the Institute have made them into an exceptionally congenial and co-operative group. The location is ideal for a summer gathering, and the "Aborigines," as the early comers dubbed themselves, developed a fine community spirit, fostered certainly by the daily news sheet and the expert ministrations of "Heiny" Harris, the steward, and "Sherry" Reeder, in charge of recreation. This spirit has extendsd to those who came later and even those who stay for only a few days. In no meeting which the writer recalls has there been such a cordial and friendly atmosphere, so much good fellowship mixed with good chemistry. Indeed, the Institute seems to have followed the policy of some of the English societies mentioned by Dr. Rideal in one of the evening talks, to obtain for the program the best speakers possible and having gotten them to give them the best time possible. If the wishes of the members indicate the feelings of the Society, the Institute will certainly become a permanent institution, though of course this year's experience will point to some modifications and improvements in the details. One thing is certain, the possibility of combining a real vacation with real progress in the study of chemistry has been realized in a number of individual cases. No one at the Institute is a loafer and no one has been found who was not enjoying his experience.

THE "ABORIGINES" of course began to gather the last week in June as some of them were taking courses in the summer session of the college. With the arrival of Dr. and Mrs. Rosengarten on the afternoon of July 4, Dr. Herty, Dr. Teeple, H. E. Howe, Harry Holmes, F. C. Whitmore, and others, the affair became a real American Chemical Society function. From then on each day saw new arrivals and some departures. The reception held in the Sigma Phi Sigma house on the evening of the Fourth, gave all the members a chance to get acquainted; and when, the next morning, it was announced that "Killie" of the A. C. S. News Service had won a new Chrysler coach at the Fourth of July carnival held by the local fire company, the Institute knew that luck was with it and that the town belonged to it. There was no longer time to worry about folks back home, or the thermometer, or unpaid bills. Special lectures in the morning, the daily conference at 11:00 a.m., laboratory, or tournament golf or tennis, or more lectures in the afternoon, movies at 6:30 on chemical manufactures and processes which regularly filled the theatre, the evening talk at 8:00 with such speakers as Mees, Holmes, Rideal, Langmuir, Kendall, and others, filled the day and evening till it was time to assemble at the Acacia fraternity and drink punch, talk, listen to the now famous "St. Cecilia Choir" instigated by such musical leaders as Mrs. James Kendall, H. E. Howe, and Harry Holmes, play bridge, chess, or dance till it was time to turn in and get ready for another day.

THE MORNING conferences have been appreciated by the press of the country as authoritatively presenting "1927 in Chemistry," and by the way, it is another indication of the spirit of the American Chemical Society that it has been possible to secure for these such speakers as Teeple, Herty, Mees, Blum, Weidlein, Rose, Sherman, and others, without funds available for paying any traveling expenses. A feature of these morning conferences which has received much favorable comment is the greater opportunity they offer for deliberation and discussion. In several instances the discussion groups met in the afternoon following lunch and no one kept track of the private arguments in the fraternity lounges and under the campus trees. The largest group, as was expected, assembled for the catalysis conferences and with an exceptional group of catalysis workers present, this offered a fine opportunity for open debate which was not allowed to pass unutilized.

The morning conferences of the third week of the Institute are devoted chiefly to discussions of special techniques, as for example, the handling of high pressures, the accomplishments of modern spectrum analysis, spectrophotometry, the determination of partical size, and as a topic of especially timely interest, a discussion of the new organic solvents. The last week is of particular interest to workers in the fields of biochemistry and nutrition, with such men present as E. C. Kendall of the Mayo Foundation, W. M. Clark of the Hygienic Laboratory, H. C. Sherman, Columbia University, E. C. Forbes and R. Adams Dutcher of Penna. State College, J. C. Drummond from England, Alfred Hess, M.D. of New York City, and Walter H. Eddy, of Columbia.

International Standards for Tannin Analyses

THE fourteenth annual meeting of the American Leather Chemists Association held at Cincinnati June 15-17 was probably the most successful meeting in the history of the association. The most important matter considered was that of an international method for tannin analysis taken up on the last day of the meeting. The report of the delegates of the association who were sent to London was accepted and it seems entirely probable that by the first of January, 1928, a provisional method will be adopted which will mean that all international tannin analyses will be on the same basis.

The association reelected Prof. G. D. McLaughlin as a member of the council and elected Karl Gustavson to the vacancy made by the retirement of A. C. Orthmann. Interesting addresses were made by Dr. K. G. Falk and Dr. Martin Fischer.

Improved Casting Practice With Mold Treatment

COATING of water-bound or baked sand molds with glycerine or ethylene glycol before casting of metal is shown by the Bureau of Standards to produce some important advantages in the character of the surface of the castings obtained. This work on mold surface coating is an outgrowth of earlier work by Osborne, of the American Magnesium Corporation, in which glycerine was recommended instead of water as a bonding material in the sand itself for magnesium castings.

Because the use of glycerine resulted in formation of acrolein, which is irritating to eyes and throat, the use of ethylene glycol was undertaken. The best results obtained by the bureau appear to have been with ethylene glycol thickened with silica flour, zirconium silicate flour, or graphite.

Fetherston Elected Secretary of Gas Association

Franklin R. Fetherston has been elected secretary-treasurer of the Compressed Gas Manufacturers' Association. He succeeds John H. Luening who resigned the office to accept a position with the Kentucky Oxygen-Hydrogen Co. of Louisville.

NEWS FROM WASHINGTON

By Paul Wooton
Washington Correspondent of Chem. & Met.

SHOULD German potash interests and American producers of phosphate rock effect an agreement along the lines now being discussed, far-reaching effects are foreseen. It would enable the Kali Syndicate to overcome the advantage now enjoyed by the I. G. by reason of its ability to sell a combined fertilizer—its nitrophoska. The American interests have going distribution machinery and would be a valuable partner for German potash producers. In turn, the plan would give the American phosphate industry a new grip on the German market from which it is being gradually crowded by Morocco.

Were Germany to turn again to America for its potash it would affect French interests so adversely that the Alsacian potash producers hardly would go along with the plan, with the termination of the Potash agreement looming as a possibility.

It is thought likely that there would be insistence that American nitrogen go into any combined fertilizer to be furnished the domestic market. This would be insured if a duty were placed upon imports of nitrate of soda such as already exists on sulphate of ammonia. There is certain to be a demand at the forthcoming session of Congress for such a duty as a necessary step to stimulate the production of synthetic nitrogen. In recent months prices have been such as to cause some hesitation in plans for producing atmospheric nitrogen. Production of alcohol or fuels seems more attractive. Something may have to be done to foster this important infant industry.

THE SATISFACTORY character of the core from one of the exploratory wells of the Bureau of Mines has aroused new hope that potash of commercial value may be found. While transportation costs may preclude competition east of the Mississippi River, a supply of potash that could be sold at lower prices in Texas alone would have a profound effect on the situation. Cheap potash in Texas would insure a remarkable expansion in the agriculture of that state, it is pointed out. The Potash Importing Corporation is said to be watching developments closely. This action and the efforts to obtain potash in Spain and Poland lead some to think that the Corporation may be as American as it has claimed to be.

IN ORDER to get judicial determination at an early date of the many questions involved in ultimate distribution of the royalties which accrued from the use of enemy-owned patents licensed during the world war, efforts are being made to secure stipulations from the several score litigants to abide by the decisions in four cases selected as representative of all the issues involved. The four cases are pending in the Federal district court for Delaware.

A number of litigants have signed the stipulation. The Department of Justice has agreed to sign for the United States government as soon as a sufficient number of complainants have agreed. It is probable the four cases all will be tried next fall and winter.

There is about $700,000 in the Treasury awaiting court decisions for distribution. Several score suits are pending in Federal district courts affecting this fund. The patents involve a wide range, chemical and mechanical.

The original Trading with the Enemy Act provided that the President might license for use in this country patents, trade-marks and copyrights registered by enemy aliens. The President designated the Federal Trade Commission as his agent in issuing these licenses. The Commission granted a number, all non-exclusive, and fixed a royalty fee after a hearing. Congress later amended the Act, providing for seizure of these patents and trade-marks by the Alien Property Custodian, who, after seizure, sold a large number, most of the chemical patents passing into the hands of the Chemical Foundation, Inc. Congress provided that within one year from the official end of the war, which would be between July 2, 1921, and the same date in 1922, owners might file suit against the licensee in the Federal district court where the licensee had his residence, for a determination of a fair royalty, regardless of the royalty fixed by the Federal Trade Commission. If the royalty so decreed was greater than that fixed by the Commission, the difference would be paid by the licensee; if less, the difference between what he had paid and what the court held as fair would be returned by the Treasury to the licensee.

THE PERPLEXING question is involved in most of the suits which have been filed regarding this fund as to who was the owner of the patent at specific periods.

The Supreme Court held in the case of the government against the Chemical Foundation that the United States was the owner of enemy property seized by the Alien Property Custodian.

Not only have original owners of patents sued for the royalty fund, but the Chemical Foundation, Inc., is suing in some cases as owner of patents after their purchase by it from the Alien Property Custodian, and the Alien Property Custodian has filed several suits for part of the fund. In the only case thus far decided by a Federal circuit court of appeals, the Third Circuit Court upheld the interest of the Alien Property Custodian as owner of a patent from the period of its seizure until he sold it.

Three periods of ownership are involved in the suits—the period of licensing by the President through the Federal Trade Commission; the period of seizure when held by the Alien Property Custodian; and the period of ownership after sale by the Alien Property Custodian.

As an accounting proposition, it is almost impossible to separate the royalties paid on specific patents into these three separate periods of ownership.

HENRY S. CHATFIELD, chairman of the industrial alcohol committee of the National Paint, Oil, and Varnish Association, appeared before the prohibition enforcement officials on July 13. Mr. Chatfield stated that generally speaking, there can be no great development of chemical industry without alcohol any more than there could be a steel industry without pig iron, an electric industry without copper, or a fertilizer industry without potash and fixed nitrogen. While alcohol may not be used directly in the manufacture of textiles, automobiles, and innumerable other ordinary articles of commerce, any chemist could draw a flow sheet to show the relation of alcohol to the units assembled in the fabrication of the finished goods.

With regard to liability of permittee, Mr. Chatfield said: "At one time proposed Regulations No. 2 sought to hold a permittee responsible for any unlawful acts of his servant, agent or employee committed without his knowledge, consent or culpable negligence; in fact, the projected form which I saw of application for a permit specifically provided that such sets shall be chargeable to the permittee 'whether done with or without the permittee's knowledge or consent'! Speaking for my association, we will fight such a proposal to the last ditch. In these days when many prohibition agents themselves have 'gone wrong' as shown by the departmental records no employer wants to be placed in a position where his permit is jeopardized or of being otherwise penalized for a violation of law attributable alone to the individual act of a crooked employee."

The favor with which confiscatory legislation is regarded in Chile is causing great concern in Washington. While at present it is aimed only at nitrate of soda and iodine, it is recognized that copper and other products of mines may be slated for similar treatment at any time. The extent to which the government is going in for price fixing and regulation of industry, it is recognized, bodes no good for foreign capital.

The policy of the United States toward expropriation and laws that are retroactive, either actually or in effect, has been annunciated clearly in the controversy with Mexico.

Government Disposes of Holdings in British Celanese, Ltd.

Sensational Rise in Value of Shares—Changes in Council of Society of Chemical Industry

From Our London Correspondent

THE RECENT sensational rise in the value of the shares of British Celanese, Ltd., has enabled the British government to divest itself of an unprofitable investment necessitated by circumstances arising out of war requirements. The history of the company since its inception in 1920 has not been a happy one but during the last year the undisputed merits of its products and a conservative financial policy foreshadowed the possibility of ultimate stability and progress, in spite of the dispute with the Holdings Co., which later saved it from disaster.

Lengthy reports have appeared in the press regarding the unfortunate differences of opinion between the brothers Dreyfus and the other members of the board of directors and of the means by which Dr. Dreyfus succeeded ultimately in getting his own way. Suffice it to say that this involved the purchase of a large number of shares in order to obtain control and that subsequently this control was consolidated by the acquisition of the government's holding of 500,000 shares, by a financial group supported by Dr. Dreyfus. Whether the optimism, energy and peculiar technical ability of Dr. Dreyfus will ultimately prove more advantageous than a cautious and conservative financial policy, remains to be seen, but additional interest is given to the position by the corresponding Celanese companies in the United States and Canada, and it must be assumed that the experience which will become available through operation in the United States will prove to be of particular advantage in regard to the future of the British company. The unknown factors are the ultimate outcome of the compulsory removal from the board of the nominees of the Cellulose Holdings Co. and the effect of competition from other quarters such as Courtaulds, Ltd., and in spite of the rise in share values, reconstruction of some kind appears inevitable.

TRAVELLERS in Europe during this summer cannot fail to be impressed by the extraordinary development of air travel, and this is particularly noticeable in Germany where commercial aviation is expanding at a phenomenal rate and is no more expensive than 2nd class travel by rail. A sign of the times in this connection is afforded by an agreement recently made between the I. G. and the Deutsche Lufthansa by which the former has guaranteed a minimum annual amount of freight. The dyestuff and pharmaceutical products of the I. G. naturally are peculiarly suitable for such methods of transport, but it seems only a question of time before the service is extended to less valuable goods, possibly on a basis similar to deferred rate cablegrams. Another pointer of interest is the reappearance of numerous advertisements by German chemical firms, in British trade periodicals which had previously discouraged them.

THE Annual Meeting of the Society of Chemical Industry was held from July 4 to July 9 in Edinburgh. This convention followed orthodox lines and appeared to present no features of outstanding interest, in fact it might be regarded in itself as a kind of preparation for the next meeting, which it is believed will be held in New York at about the time when the Institution of Chemical Engineers is to pay its return visit to the American Institute. This year's recipient of the Society of Chemical Industry's Medal was Col. G. P. Pollitt, a director of Imperial Chemical Industries and of Synthetic Ammonia and Nitrates.

Some interesting changes in the Society's Council may be recorded, such as the election of Dr. E. F. Armstrong as honorary foreign secretary in place of Dr. Herbert Levinstein, while Dr. E. W. Smith of the Woodall Duckham Co. replaces E. V. Evans as honorary treasurer. The new chairman of the Chemical Engineering Group is E. C. Williams, Prof. of Chemical Engineering at University College and H. J. Pooley is the new honorary secretary in place of Harold Talbot, who has been the life and soul of the group since its inception.

THE CONTROVERSY as regards the future home of London University has been settled by the acquisition of the Bloomsbury site between Holborn and the Euston district where University College is located. It is too early to forecast the ultimate effect, but it seems a pity that advantage was not taken some time ago of securing available sites near the Institute of Chemistry in Russell Square for housing chemical and other learned societies as thereby the dream of Chemistry House might have been brought appreciably nearer.

Last month the new War Memorial Hall at University College was formally opened and in general both the general public and also industrial undertakings are taking a greater interest in the products of university education. The largest technical organizations are not only farming out some of their research work to University laboratories, but are thus indirectly keeping a watchful eye on individual research students, with the result that those of outstanding merit are quietly absorbed by means of attractive offers made before the end of their training.

The professorial staff is also not exempt from the modern tendency of attracting the best brains to industry, but the results are sometimes a little disturbing to the ultimate welfare and standard of training at the university itself. There is also a growing tendency to permit and encourage consulting work by the teaching staff and recently there has been a better understanding of its value and emoluments.

Legislation to Aid Canadian Coke Production

U. S. CONSUL J. D. Hickerson, at Ottawa, Canada, has summarized as follows an "Act to Encourage the Production of Domestic Fuel from Coal Mines in Canada," which act received Royal assent on April 14, 1927.

"The Act is primarily to assist the coal mining industry in the Maritime Provinces but is general in its application. Under it the Minister of Mines may enter into an agreement for a period not exceeding 15 years with any person approved by the Governor in Council for the construction and operation of coal works. By 'works' is meant by-product recovery coke oven plants or such other carbonizing plants as have for their object the production by heat-treatment from coal of a coke suitable for domestic use and of gas, tar, and other by-products.

"The Act authorizes an annual payment to any contractor of a sum equal to 4 per cent of the cost of constructing the works if the contractor be an individual, and a sum equal to 5 per cent of the cost of the works if the contractor be a municipality or other public corporation. It is provided, however, that the payment shall, in every case, be reduced by 5 per cent for each unit of percentage by which the quantity of coal mined in Canada used in the works for the production of coke falls below 70 per cent of the total quantity of coal so used. Under the terms of this proviso, therefore, companies which use only 50 per cent of Canadian coal would receive no benefits whatever from the Act."

Industrial Gas Symposium Planned for Detroit

"THE Chemistry of Industrial Gas" is the title of a symposium planned by the gas and fuel division of the American Chemical Society for its meeting at Detroit during the first week of September. The officers of this division of the society are urging the authors of papers to interpret the subject broadly, in order that a wide variety of treatment may be assured. It is desired, however, that authors avoid the presentation of purely descriptive papers on plants or processes. It is also desired that economic conditions be given appropriate attention in addition to the scientific factors affecting industrial gas.

High Import Tariffs To Protect French Chemical Industry

Maximum Duties Make French Markets Independent of Outside Competition, With Regular Imports Greatly Increased

From our Paris Correspondent

LAST YEAR was most profitable for French industries, particularly manufacturers of chemicals, in spite of the business difficulties caused by the monetary situation. As a striking example of this statement there follows the report on profits made by the undermentioned firms:

Firms	Capital Invested, Million Francs	Net Profits, Francs
Alais, Froges, Camargue	208	42,690,000
Kuhlmann & Co.	190	32,690,000
Manufacture de Saint-Gobain.	161	46,788,000
Matières Colorantes de St. Denis	30	7,520,200
Bozel-Malétra	50	11,572,200

Prospects for 1927 do not appear to be as favorable. Business had slackened in December and has slowed down increasingly. The home market suffers from a general consumption crisis, the only element of real activity being the export market where prices are not remunerative owing to the rise of the franc. Competition on the export market has become very severe for the French chemical industry owing to the growing activity of the I. G. of Germany.

Mention already has been made of how the Germans had brought the Japanese chemical industry in their power. At present the Spanish chemical trade is also entirely in their hands and according to very recent news Great Britain has also come to an agreement with them.

CONCERNING Spain the facts are that by request of the Fabricacion Nacional de Colorantes y Explosivos, strongly supported by the I.G., the Spanish government recently issued two bills, the first one prohibiting the import of foreign chemical products into Spain, the second stating that a Spanish concern may have 50 per cent of its capital invested in foreign hands and still be called a Spanish firm. This bill allowed the I.G. to double its capital in the Spanish firm which is now of 7 million pesetas. It appears that in 1927 all coloring matters and intermediary products on the Spanish market will be sold by the I.G. offices in Spain, thus the so-called Fabricacion Nacional is entirely under subjection of the I.G. for all sales of dyestuffs, explosives and shortly poisonous gases in Spain.

It may be added that a royal decree of Jan. 28, 1927, grants to this half-Spanish and half-German firm a 50 per cent discount on all taxes and even profits during eight years. The company will not pay either import or custom duty on all working stocks used for the manufacturing of dinitro-chloro-benzol and 40 tons of dinitro phenol will also be free of all taxes and duties which will naturally come from Germany.

Obviously the I.G.'s activity eliminates, little by little, the French chemical industry from every foreign market till it finally will lead its big offensive on the French market itself. In anticipation of this the new French custom tariff has placed heavy duties on dyestuffs and intermediate products and even heavy chemicals which tariff will act as a wall of protection for the home industry.

Following are instances of the comparative duties levied by the present old tariff and the minimum duties levied by the new tariff. Maximum duties, which reach staggering heights, are not included.

	Present Tariff per 100 Kilog. Francs	New Tariff per 100 Kilog. Francs
Nitric acid:		
(a) of less than 53 per cent monohydrate	......	60
(b) of more than 53 per cent monohydrate and less than 81 per cent	8	90
(c) of 81 per cent monohydrate and more	22,40	90
(d) commercially pure	38,40	100
Sodium nitrate	26,40	60
Nitro- and amidosalicylic acids	384	750
Benzoic acid compounds	576	1175
Benzidine and its salts	264	1000
Benzaldehyde or benzoic aldehyde	288	500
Monoazoic dyestuffs	480	1600
Polyazoic dyestuffs	480	1750 3750
Thioflavine	480	4000
Sulphur colors:		
Black	720	1400
Other colors	720	2000
Colors derived from carbazol	720	2250
New methylene blue	720	2300
Vat colors:		
Derived from anthraquinone	960	7500
Thioindigos and colors derived from it	960	4000
Synthetic indigo	720	1700

ON THE first of June the centenary of the discovery of alizarine by the French chemists Robiquet and Colin was duly celebrated at the Paris Conservatoire des Arts et Métiers. The works of Graebe and Liebermann were opportunely recalled. These German chemists had, in order to produce commercially the synthesis of alizarine, founded the Ludwigshafen plants which have become the present B.A.S.F. In 1881 Messrs. Poirrier and Dalsace put into operation this same manufacture in their plants which have become the Manufacture des Matiéres Colorantes de Saint-Denis. But they had to stop manufacturing synthetic alizarine when German producers lowered the price of the 20 per cent paste from 5 Mk50 to 2 Mk50.

The manufacturing of synthetic alizarine was restored in France after the war by Kuhlmann. It should be noted that whereas this firm's output in 1921 was 65,000 kg. of 20 per cent paste, the 1926 output reached 510,000 kg. at an average price of 20 frances per kg. The new customs tariff naturally contemplates very high taxes on this dyestuff.

PREVIOUS mention has been made of the establishment of the Society Le Kétol which uses the Lefranc processes. This firm manufactures butyric acid starting from sawdust. By distilling butyrate of lime, ketol is obtained which is a mixture of ketones. This ketol has been sold as a carburant but it cannot be used normally, its price being far too high. Concerning butyric acid, uses of it are relatively few especially with a 95 per cent product sold at 27 francs per kg. It is reported that the Society Le Kétol is building new works near Saint-Dié in the Vosges. The main object is to get cheaper sawdust. But, besides, they seek to avoid the constant complaints made against the Ris Orangis plant by the population of that locality and other neighboring Paris suburbs.

The Société des Brevets Lefranc has the exclusivè rights for the manufacture of ketol by the Lefranc process in all foreign countries. This firm has leased its rights for Switzerland to the Society Ketolea of Geneva for a million gold francs and a yearly royalty of 25 per cent on net profits.

The researches made by another Geneva firm, Naef & Co., have led to the discovery of the composition of natural musk and the synthesis of the so named *exaltone*, an odoriferous product almost similar to musk in composition and fragrancy. The researches made by Messrs. Ruzicka and Chuit have shown that civettone from civet and muscone from musk are carbocyclic ketones that may be synthetised by distilling metallic salts of dicarboxylic acids containing 17 atoms of carbon.

New Sulphur Product Suited for Agricultural Use

AS THE outcome of experiments and investigation of Prof. E. R. deOng, assistant entomologist, experiment station, University of California, a new sulphur product has been developed which is said to have definite merits for agricultural purposes. The material is a byproduct of the manufacture of gas from oil, containing a small portion of active salts of hydrocarbons from the oily residue which, it is claimed, gives increased value for spraying or dusting. The new product has been demonstrated to be extremely useful for the control of pests, in soil fertilization and in neutralizing black alkali, due to the fineness of division of the sulphur particle itself. The material is a light gray in color, very light and fluffy, adhesive, and not readily washed away by rain.

Removal of Trade Barriers Urged at Geneva

By E. J. Mehren
Vice-President, McGraw-Hill Publishing Co., Inc.

CONSIDERING trade barriers the chief obstacle to European economic recovery, the International Chamber of Commerce has devoted its major attention to methods of their removal. Taking as a text the conclusions of the economic conference at Geneva which, in turn, were based on an exhaustive study of the Chamber's Trade Barrier Committee, it unanimously endorsed the Geneva conclusions.

The delegates were told by Sir Arthur Salter, head of the economic section of the League of Nations, and by leaders of the various delegations, that they had a moral responsibility to work in their countries for the enactment of necessary legislation to make the Geneva conclusions operative; that trade barriers are strangling the nations economically; that millions are suffering; and that a reduced standard of living is general as a result.

Other important conclusions for facilitating international trade and commercial relations relate to transport, uniform regulations regarding checks and bills of exchange and export credit. In a report, trade barriers in an international sense were defined as "those arbitrary national restraints on free movement of goods, capital and services which not only restrain trade and traders but limit the economical production and distribution of goods, capital and services to the detriment of the peoples affected by the restraint. In production there is a unit of maximum economy; in distribution there is a market of maximum economy. Any barrier which prevents the co-ordination of these two is a trade barrier in the sense used by the Chamber."

THE CHAMBER pledged itself to co-operate with the League of Nations in carrying out the Geneva conclusions, and asked its national committees to urge their governments to accept the conclusions and take appropriate action (the conclusions have already been endorsed by Belgium, Austria, Germany, Czechoslovakia, Holland and Sweden, with expressed willingness to take necessary legislative steps). It endorsed the Geneva declaration that tariff walls and policies which directly or indirectly hamper trade should be reduced or removed; expressed satisfaction that the League will call a diplomatic conference to draft conventions giving equality of treatment to foreigners admitted into any country and defining the conditions for exercising trade and the taxation of foreigners; advocated the abolition of passport visas; and urged the nations which have not done so to ratify the navigable waterways and maritime port conventions concluded at Barcelona and Geneva so that transportation barriers could be removed.

The Chamber also endorsed the abolition of prohibitions on exports and imports and a lowering of the tariff where it is unduly hampering, a simplification of tariffs and the unification of customs nomenclature; long-term treaties to prevent tariff fluctuations; the abolition of exaggerated consular fees and unjustifiable health measures; the removal of prohibitions on and artificial hindrances of free international movement of capital; and finally endorsed the Geneva conclusions on rationalization and international industrial pools.

Aberto Pirelli, a rubber manufacturer of Milan and a member of the Dawes Committee and of the Italian debt-funding committee to the United States, was elected president of the International Chamber. Amsterdam was selected as the site for the next convention, which is to be held in 1929.

Larger Output of Graphite in 1926

THE GRAPHITE industry was more productive in 1926 than it was in 1925, according to a statement by the United States Bureau of Mines. The sales of natural graphite by producers in 1926 were 5,145 short tons, valued at $209,592, an increase of 480 tons, or 10 per cent, in quantity, and of $113,231, or 118 per cent, in value, compared with 1925. The increase was in the crystalline variety, amorphous graphite decreasing in both quantity and value. The 1926 sales of amorphous graphite amounted to 2,650 short tons, a decrease of 886 tons, or 25 per cent, compared with 1925. The value of the amorphous graphite in 1926 was $30,750, a decrease of 22 per cent compared with 1925. The sales of crystalline graphite in 1926 were 4,989,200 lb., valued at $178,842, an increase of 2,731,950 lb., or 121 per cent, and of $122,121, or 215 per cent, compared with 1925. The quantity and value of crystalline graphite in 1926 were the largest since 1920. The manufacture of artificial graphite in New York increased considerably—from 12,135,655 pounds in 1925 to 21,163,986 pounds in 1926, or 74 per cent.

News in Brief

THE INTERNATIONAL trade fair which has been held at Leipzig for centuries will be open this year from Aug. 28 to Sept. 3. More than twenty countries will be represented in the display of products and the exhibits are expected to exceed 7,000 in number.

SALT PRODUCTION in Canada continues to increase; the high record of 233,746 tons produced in 1925 was topped by a new high mark of 262,547 tons in 1926, according to final statistics just issued by the Mining, Metallurgical and Chemical Branch of the Dominion Bureau of Statistics. The value of the 1926 output was $1,480,149, as compared with $1,410,697 for the 1925 production. The average price for all grades declined somewhat, being $5.63 per ton in 1926, as against $6.04 in 1925.

A RECENT INVENTION in Denmark makes it possible to transfer photographs to porcelain, it has been reported to the Department of Commerce. The invention, it is claimed, transfers pictures to the porcelain before the process of burning, so that the picture appears beneath the glass. The glass is said to be entirely clear and transparent and protects the picture against chemicals. The porcelain is finished in a light blue color.

CANADIAN EXPLOSIVES, LTD., which is a holding company for five operating concerns, has changed its corporate title to Canadian Industries, Limited. Holders of Canadian Explosives common will receive six shares of the new company's stock for one of old, giving the company an issued common capital of 649,950 no par value shares. There will also be outstanding $4,650,000 of preferred stock similar to that of the old company. The companies controlled by Canadian Industries, Limited, are Explosives, Limited, Dominion Cartridge Co., Ltd., Canadian Fabrikoid, Ltd., Flint, Paint and Varnish, Limited, and Arlington Company, of Canada, Limited.

A PROJECT IS said to be under way at Newport, N. H., for the establishment of a mill for the manufacture of certain papers from kelp. Henry W. Brown, president and treasurer of the Gordon Woolen Mills, Newport, is at the head of the enterprise. It is purposed to take over the local mills of the Peerless Mfg. Co., heretofore devoted to textile operations, and to remodel and equip for the new industry.

COLUMBIAN CARBON CO. has completed and placed in operation a new carbon black plant in Hutchinson Co., Texas Panhandle, which is utilizing 40,000,000 cu.ft. of natural gas a day from Phillips Petroleum Co. Capacity of the plant is in excess of 15,000,000 lb. of carbon black a year.

MORE THAN 25,000 executives, shopmen and scientists of metal working and treating industries all over the world will gather in Detroit the week of Sept. 19 for the technical sessions of four associations and for the National Steel and Machine Tool Exposition. During the week the exposition is running in Convention Hall, Detroit, the American Society for Steel Treating, the Institute of Metals, the Society of Automotive Engineers, and the American Welding Society will be meeting twice daily, from Monday through Friday, in the Statler Hotel, Detroit.

ITALY BECAME THE second largest producer of rayon in the world in 1926 with an output of 37,400,000 lb., 7,000,000 lb. more than in 1925, according to advices to the Department of Commerce. The United States still leads in production. Home consumption of rayon during 1926 has been estimated at approximately thirteen and a half million pounds. Italian rayon manufacturers export from 50 per cent to 60 per cent of their production.

MEN you should know about

WILLIAM H. MCADAMS, at a recent meeting of the Corporation of the Massachusetts Institute of Technology, was elected full professor of chemical engineering.

IRENEE DUPONT sailed for a trip abroad on July 6, accompanied by his family, for a vacation in Europe.

GORDON R. POLE, the recipient of the National Terra Cotta Fellowship, is now located at the Bureau of Standards, Washington, D. C., engaged in research. He was formerly in the research division at the Mellon Institute.

J. H. CALBECK has tendered his resignation as director of research for the Eagle-Picher Lead Co., Chicago, Ill., to engage in private research work.

ARTHUR R. HITCH, formerly with E. I. duPont deNemours and Co. has accepted an appointment as chemical director for the Gillican-Chipley Co., New Orleans, La., effective at once.

M. E. FLENTJE, heretofore chemist for the municipality of Oklahoma City, Okla., in charge of water distribution, is now with the Community Water Service Co., in charge of chemical and other supervision in the district comprising Pennsylvania, Ohio, New York and Illinois, with headquarters at Harrisburg, Pa.

DR. MAURICE E. SMITH has been appointed professor in chemistry at Worcester Polytechnic Institute, Worcester, Mass. Dr. Smith was graduated by the University of New Brunswick, N. S. in 1917, and received the degree of Ph.D. from the University of Toronto in 1921. Later he engaged as a lecturer in organic chemistry at the Queen's University, Kingston, Ont.

M. EDMOND FOUCHE of France, has been awarded the Morehead medal of the International Acetylene Association, in recognition of his invention of the oxy-acetylene torch for welding.

WILLIAM P. HEMPHILL has been appointed director of the new department of research established by Armour & Co., Chicago, Ill. He has also been elected a vice-president of the company.

EUGENE R. MANNING of Ridley Park, Pa., chemical engineer, has received the honorary degree of doctor of philosophy in chemistry from the University of Pa. He was formerly chemical engineer and research chemist with duPont and later with the testing and research division of the National Aniline & Chemical Co., Marcus Hook, Pa.

DAVID ROSENGARTEN of the Powers, Weightman, Rosengarten Co., Philadelphia, Pa., received the degree of D.Sc., from the University of Pennsylvania at the recent commencement.

COL. AUSTEN COLGATE of Colgate and Co., Jersey City, N. J., received the honorary degree of Doctor of Laws from Colgate University, Hamilton, N. Y.

EDWARD J. MEHREN, vice-president and chairman of the editorial board of the McGraw-Hill Publishing Company, arrived home July 12. Mr. Mehren went abroad to attend the sessions of the Economic Conference at Geneva to study industrial conditions in Italy and Germany and to attend the meeting of the International Chamber of Commerce at Stockholm.

ELMER A. HOLBROOK, dean of the School of Mines and Metallurgy at Pennsylvania State College, has been appointed dean of the Schools of Engineering and Mines at the University of Pittsburgh. He succeeds Dr. FREDERICK L. BISHOP and will take office September 1. Dr. Bishop plans to devote his time to research and teaching. He will continue as professor of physics and as consulting engineer.

F. J. LOMBARD, formerly with the Union Bag and Paper Corp. is now with the engineering division of the Taggart-Oswego Paper Bag Corp., Oswego, N. Y.

DR. D. J. MCADAMS, JR., metallurgist, United States Naval Academy engineering experiment station, Annapolis Md., has received the Charles B. Dudley medal established by the American Society for Testing Materials, the first award of this honor.

D. C. WYSOR, ceramic engineer, is now with the General Chemical Co., New York.

R. E. GOULD, heretofore ceramic engineer for the R. Thomas & Sons Co., East Liverpool, Ohio, manufacturer of electrical porcelain, has been appointed director of the research department of the Taylor, Smith & Taylor Co., Chester, W. Va., manufacturer of chinaware.

VANCE EDWARDS, who has been with the Forest Products Laboratory, for some time past, has resigned to become manager of the Northwestern Pulp & Paper Co., Astoria, Ore.

GUSTAVE WHYTE THOMPSON, chief chemist of the National Lead Co. delivered the graduation address at the Armour Institute commencement exercises in Chicago, June 9, and received the honorary degree of D.Sc.

H. S. KARCH has resigned as chemical engineer with the National Carbon Co., Research Laboratories, Cleveland, Ohio, to become assistant chemical engineer on field work, Fuel Section, U. S. Bureau of Mines, on refractories investigation in conjunction with the American Society of Mechanical Engineers.

HENRY L. COLES, who has been for the past four years manager of the Guardian Metals Co., has been promoted to the position of vice-president of that company.

DR. LEO H. BAEKELAND has purchased the William Jennings Bryan home in Coconut Grove, Miami, Fla.

G. J. FINK, formerly chemical director of the National Lime Association with headquarters in Washington, D. C., has left this position to become head of the new research department of the Chicago Chemical Co., water service engineers. He assumed his new duties on July 6.

E. L. ROBINS, president of the Meridian Fertilizer Factory, Meridian, Miss., has been elected president of the National Fertilizer Association. L. W. Rowell was elected vice-president, Charles J. Brand, re-elected executive secretary and treasurer.

J. V. N. DORR, president of The Dorr Co. had conferred upon him the degree of Doctor of Science by Rutgers College at its commencement on June 11.

CHAPLIN TYLER, assistant editor of *Chem. & Met.* has been on a tour visiting industrial centers in the middle West. He visited Cleveland, Columbus, Cincinnati, Indianapolis, Terre Haute, Urbana, Chicago, and after a visit in the vicinity of Boston will return to the New York office the end of July.

THEODORE F. MERSELES has been elected president of the Johns-Manville Corp. H. E. Manville, who has served as president since the death of his brother, T. F. Manville in 1925, has been elected chairman of the board of directors.

WILLIAM G. RUDD has been elected vice-president in charge of operation of the Peoples Gas Light and Coke Company, succeeding the late John H. Eustace.

A. C. FIELDNER was tendered a dinner by members of the staff of the Pittsburgh experiment station of the Bureau of Mines on June 28. Mr. Fieldner, former superintendent of the station, has been transferred to Washington to take charge of the division of experimental stations.

E. K. GLADDING, production manager and Dr. W. H. Church, assistant chemical director, of the duPont Rayon Co., Buffalo, left early in July for a trip abroad to visit the European rayon plants of the Comptoir des Textiles Artificiels. The following men have recently joined the ranks of the Chemical Division: Dr. Van L. Bohnson, formerly with the Oldbury Electrochemical Co. of Niagara Falls, N. Y.; Dr. Robert F. Heald, from Ohio State University; Dr. W. L. Hyden, formerly head of the chemistry department of Center College, Danville, Ky.; Dr. Roy McCracken, from Iowa State College and Dr. F. H. Swezey, formerly with the Air Reduction Co., New York.

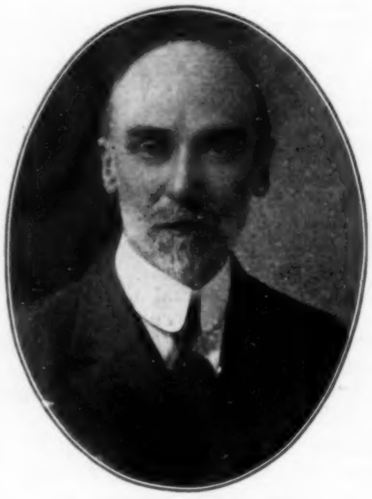
OBITUARY

Dr. Victor Lenher, professor of chemistry at the University of Wisconsin, died June 12 at the age of 54. According to the University of Wisconsin *Press Bulletin* Dr. Lenher's death was probably caused by chronic nephritis, as announced by officials of the Wisconsin General Hospital at the conclusion of a preliminary autopsy. For 27 years Dr. Lenher has been a member of the university chemistry faculty. He was a graduate of the University of Pennsylvania with the class of 1893, and received the Ph.D. degree from the same university in 1898. After teaching at the University of California and Columbia University, he came to the University of Wisconsin. Dr. Lenher's most notable contributions to science were his extensive studies of the chemistry of selenium and tellurium, two comparatively rare elements which are found in copper ore. Perhaps the most notable of these discoveries was selenium oxychloride, a solvent of many materials commonly thought to be insoluble. He also did research on "rare earths" and on the chemistry which underlies the deposition of minerals in ore formation. More than 70 articles concerned with researches he directed have been published in scientific journals.

Dr. Charles F. Mabery, head of the department of chemical engineering at Case School of Applied Science from 1883 to 1911 and since then Professor Emeritus, died Sunday, June 26, 1927. He was born in New Gloucester, Maine, Jan 13, 1850. In 1873 he entered Harvard and three years later was graduated from the Lawrence Scientific School, being one of the few to receive the degree of Doctor of Science in the Harvard Graduate School. His first position was an assistant in chemistry at Harvard College and for ten years Director of the Harvard Summer School in Chemistry for teachers. From there he was called, in 1883, to become professor of chemistry at Case School of Applied Science which position he occupied until 1911, when he retired from active teaching work on account of ill health. After that he spent all the time his health would permit in research and travel. In the petroleum field he was pre-eminent, not only in this country, but the world over. He also occupied himself largely with the constitution and action of lubricants. To his students and friends, Professor Mabery was best known as a lovable and vigorous teacher of his science. Case students were inspired by his enthusiasm and skill as a lecturer and his special students by his knowledge and assistance in research work.

Dr. Henry P. Talbot, dean of the Massachusetts Institute of Technology, died quite unexpectedly in Boston, June 18. Although he had been in ill health for several months, he was recuperating from a recent operation and the physicians were sanguine of his recovery. He took a sudden turn for the worse and died within a few hours. He was 63 years old.

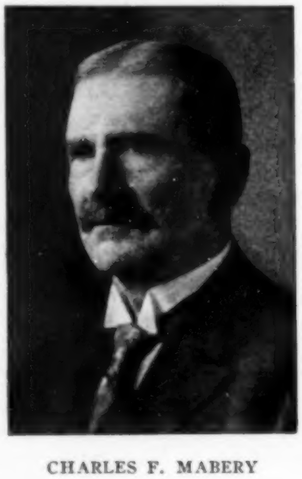
Dean Talbot had been prominently identified with chemical education for thirty-five years, having joined the faculty of Technology in 1892 as an assistant professor. Promoted to the position



HENRY P. TALBOT

of professor of analytical chemistry in 1898 he held this position until 1902 when appointed professor of inorganic chemistry. At this time he became head of the department of chemistry and chemical engineering and when the department was divided he retained control of the department of chemistry and chairman of the faculty until 1921. Since that time he served as dean of students.

Dr. Talbot was the author of an important text book on quantitative chemical analysis and since 1916 served as editor-in-chief of the International Chemical Series of textbooks published by the McGraw-Hill Book Co.



CHARLES F. MABERY

CALENDAR

American Chemical Society, Detroit, Mich., Sept. 5 to 10.

American Electrochemical Society, Northwestern trip, visiting industrial plants at Minneapolis, Butte, Anaconda, Wallace, Kellogg, Spokane, Seattle, Vancouver, Great Falls, Omaha and Keokuk, Sept. 4-20.

American Institute of Chemical Engineers, St. Louis, Mo., Dec. 5-8.

American Society for Steel Treating (ninth annual convention and exposition), Detroit, Sept. 19-24.

National Exposition of Chemical Industries, (11th) Grand Central Palace, New York, Sept. 26-Oct. 1.

National Symposium on General Organic Chemistry (second) Ohio State University, Columbus, Ohio, Dec. 29-31.

INDUSTRIAL NOTES

C. O. Bartlett and Snow Company has placed W. C. Schade in charge of the Pittsburgh office which is located at 406 Bessemer Bldg., Pittsburgh, Pa.

Foote Bros. Gear and Machine Co., Chicago, Ill., make the following announcements: Briggs-Shaffner Co., Winston-Salem, N. C., as district representative on IXL speed reducers and gear products for the state of North Carolina; G. W. Craighead as district representative for the Eastern half of the state of Michigan, with headquarters at 4-230 General Motors Bldg., Detroit, Mich.; A. H. Tischer, who has been transferred to the sales organization and is covering territory in the city of Chicago, South of 39th St., the suburbs and the steel district in South Chicago and Northern Indiana; the handling of its products in the Northern half of the state of Oklahoma by the Circle Corp., P. O. Box 1224, Tulsa, Okla.; and the appointment of the Houston Armature Works of Houston, Texas as local representatives for that district, and who will operate under the jurisdiction and direction of the Dallas representative, Geo. J. Fix Co., 2507 Commerce St.

The Quigley Furnace Specialties Co., New York, announce the appointment of J. W. Marshall as advertising manager.

The Brown Instrument Co., Philadelphia, Pa., has opened a midwestern repair and service station at 217 East Illinois Street, Chicago, Ill.

The William Ganschow Co., announces the appointment of the Schroer Bros., 2303-5 Holmes St., Kansas City, Mo., as exclusive representative in the states of Kansas and Oklahoma.

Stockham Pipe and Fittings Co., Birmingham, Ala., has appointed C. L. "Tod" Wilkins as New York manager. J. W. Stanfiel, who has been manager of the New York warehouse, is returning to the South because of the condition of his wife's health.

The Link-Belt Company, Chicago, announces that R. P. Shimmin has been appointed assistant to the chairman and the president, and will hereafter make his headquarters at 910 S. Michigan Ave. Frank B. Caldwell has been appointed sales manager with headquarters at Chicago.

The Chicago Pneumatic Tool Co., New York, announces the removal of its St. Louis office, service department and warehouse to 1931 Washington Avenue.

The Dayton-Dowd Co., Quincy, Ill., announces the appointment of James E. Degan Co., 622 First Street, Detroit, Mich., as district representative for the Detroit district.

The Contact Metals Company has moved to larger quarters at 2500-2 South Wabash Avenue, Chicago, and has combined under one roof its laboratories and offices.

The Mobile Chamber of Commerce has issued a 20-page booklet "The Port of Mobile," which should be of interest to industrial men seeking information on industrial plant sites in the South. It is illustrated by a map of industrial Mobile, a chart of the Mobile port of development, maps of Alabama's river system, Mobile Bay, and the territory tributary to Mobile as a port of trade, and others. It describes the state terminals at Mobile, the coal and material handling plant, the port administration and facilities, the railroads and inland waterways serving Mobile, its financ'al institutions and various other facilities that Mobile has to offer industry.

MARKET CONDITIONS *and* PRICE TRENDS

Smaller Industrial Demand for Naval Stores Last Year

The statistical review will be found in the accompanying tables including figures for production stocks, and consumption according to industries.

Miscellaneous consumption and large export shipments were factors in absorbing the increased output of turpentine and rosin.

INDUSTRIAL consumption of turpentine and rosin, the leading products of the naval stores industry, showed a material decline for 1926 as compared with 1925. The falling off was especially prominent in the paint and varnish industry. As production of rosin and turpentine was on a larger scale in the 1926-27 season, the reduced outlet for these products in manufacturing lines would have resulted in a large increase in stocks had it not been for a larger export movement and apparently a wider use of turpentine in miscellaneous lines with the greater part of the surplus undoubtedly being used as a paint thinner.

THE Bureau of Chemistry and Soils, which is handling the research work formerly done by the Bureau of Chemistry, has just issued a report on the naval stores industry.

Statistics are not available on production of gum turpentine and gum rosin for the 1926-27 season. Trade estimates indicate a production of approximately 510,000 casks of turpentine, equivalent to 25,500,000 gal., and 1,700,000 round barrels of rosin. No information is available on the quantity of turpentine and rosin held at the gum turpentine stills throughout the country on March 31. With these exceptions, it is possible to include in the report complete data on the naval stores trade of the country for 1926-27.

In addition to the production of turpentine by distillation of the gum from living pines, three kinds of classes of turpentine are now being produced from resinous wood, by the steam solvent process, by the destructive distillation process, and as a by-product in the manufacture of paper pulp by the sulphate process. There are no statistics available on the quantity of turpentine recovered in the manufacture of paper pulp. The quantity is as yet relatively small.

Table I—Industrial Consumption of Turpentine and Rosin During 1926 and 1925*

Industry	1926 Turpentine, Gal.	1926 Rosin, 500-Lb. Bbl.	1926 Mineral Thinners, Gal.	1925 Turpentine, Gal.	1925 Rosin, 500-Lb. Bbl.	1925 Mineral Thinners, Gal.
Paper and paper size	6,956	325,312	....	5,874	313,365	....
Soap	5,373	236,514	166,231	3,540	281,230	72,448
Paint and varnish	4,428,447	219,530	51,112,008	5,705,414	228,207	49,079,087
Shoe polish	534,079	1,078	300	824,463	338	2,841
Printing ink	12,572	14,161	97,942	10,879	14,195	18,986
Oils and greases	180,871	57,752	34,312	124,785	53,616	71,652
Sealing wax, pitch, insulations and plastics	66,291	51,500	130,181	61,058	46,564	240,954
Matches	....	2,815	....	226	2,807	....
Linoleum	5,524	44,357	126,834	4,165	37,747	115,986
Chemicals and pharmaceuticals	29,061	5,201	....	77,041	2,988	....
Automobiles and wagons	280,585	907	866,921	276,570	360	117,490
Foundries and foundry supplies	16,179	21,052	64,020	22,024	20,748	31,958
Shipyards	16,042	102	26,290	15,750	76	21,810
Miscellaneous	35,069	3,804	12,700	42,326	2,063	16,875
	5,617,049	984,085	52,637,739	7,174,115	1,004,304	49,790,087

* Consumption data are for calendar year. Other data are for the fiscal year of the naval stores industry, ending on March 31 following. In most industries a few concerns did not report after repeated requests. To cover these, estimates were made to make the figures reported herewith as nearly correct as possible. These estimated quantities are less than 5 per cent for any industry.

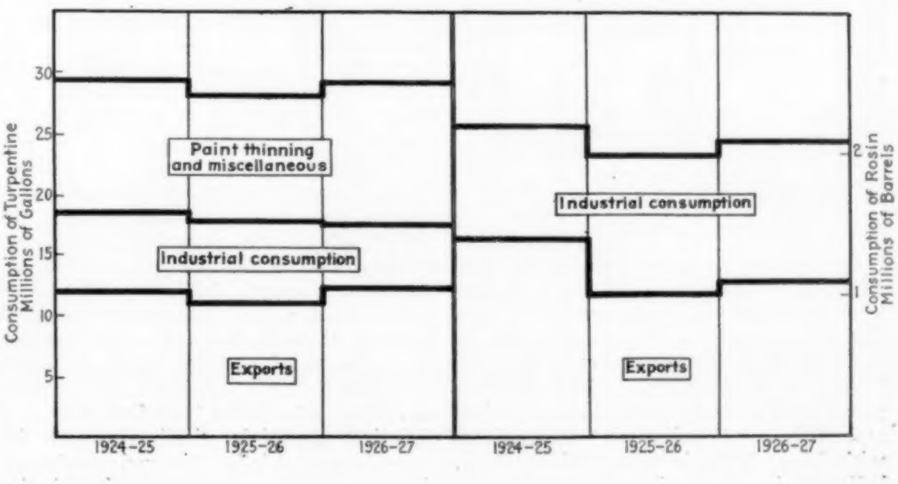
Table II—Stocks on Hand and En Route, as of March 31st

	Turpentine, Gal. 1927	Turpentine, Gal. 1926	Turpentine, Gal. 1925	Rosin, 500 Lb. Bbl. 1927	Rosin, 500 Lb. Bbl. 1926	Rosin, 500 Lb. Bbl. 1925
Gum turpentine stills	No data available	378,400	457,550	No data available	92,245	150,045
Steam distillation plants	347,627	142,847	681,236	53,866	22,616	45,462
Destructive dist. plants	91,779	91,097	65,000	....	....	....
Southern primary ports	1,585,683	1,576,550	1,579,500	125,556	148,271	225,188
Eastern dist. points	222,792	235,500	143,000	7,439	3,801	8,134
Central dist. points	369,403	685,050	602,200	5,577	11,132	19,435
Western dist. points	108,021	94,500	237,100	1,065	613	2,188
Plants of industrial concerns included from Table I	1,058,412	848,890	1,265,018	147,442	165,543	195,636
		4,052,834	5,326,581		444,221	646,088

Table III—Summarized Statistics of Naval Stores Trade

	1926–1927 Turpentine, Gal.	1926–1927 Rosin, Bbl.	1925–1926 Turpentine, Gal.	1925–1926 Rosin, Bbl.	1924–1925 Turpentine, Gal.	1924–1925 Rosin, Bbl.
Stocks at close preceding season	4,052,834	444,221	5,030,604	646,088	5,326,581	999,347
Production	29,483,055	2,105,480	27,261,425	1,903,370	29,333,450	2,018,296
Imports	306,586	22,767	287,379	17,068	177,675	1,574
Total supplies	33,842,475	2,572,468	32,579,408	2,566,526	34,837,706	3,019,217
Exports	12,794,850	1,129,614	11,361,500	1,083,131	12,485,150	1,463,168
Industrial consumption	5,617,049	984,085	7,174,115	1,004,304	6,739,621	864,841
Stocks at close of season	Complete data not available		4,052,834	444,221	5,030,604	646,088

Consumption of Rosin and Turpentine, 1925-27



MARKET CONDITIONS *and* PRICE TRENDS

Output of Chemicals Holds Up to Seasonal Standards

ACTIVITIES AMONG producers of chemicals are reported to be holding well up to seasonal standards. In the majority of cases, production has slowed down as compared with the months immediately preceding but the comparison with the corresponding period is very favorable. The movement from producing points also has been satisfactory but in some instances stocks have accumulated in producers hands. This has resulted in some irregularities in prices and sales, especially for export, have been made at concessions from the quoted levels. This is by no means general however, as some chemicals have been in such active demand that premiums have been placed on prompt shipments because of the scarcity of stocks. Total consumption of chemicals for the month, undoubtedly was cut down as a result of reduced operations in large consuming industries but the decline was not large, and optimistic reports are general regarding recoveries in both production and consumption of chemicals in the third quarter of the year.

Activity in insecticide chemicals has been prominent in the last two months. Copper salts, especially copper sulphate, have sold in larger volume than usual. The situation also is favored by reports of boll weevil damage to the cotton crop, which may bring about an active trading period in arsenic and calcium arsenate before the end of August.

INDEXES OF employment prepared by the Bureau of Labor trace the progress of chemical manufacture and consumption in a comparative way. The latest figures available refer to operations in May and show employment as follows:

Indexes of Employment

	May, 1927	April, 1927	May, 1926
Dyeing and finishing textiles	98.3	100.1	97.3
Leather	87.4	88.8	89.3
Paper and pulp	92.2	94.2	96.4
Chemicals	93.2	96.7	94.1
Fertilizers	89.9	142.3	91.2
Petroleum refining	97.6	100.3	98.8
Glass	94.9	96.4	99.4
Automobile tires	116.0	111.8	107.8
All manufacturing	89.7	90.6	91.7

On this comparison, production of chemicals in May was 3.5 per cent less than in April and was nearly 1 per cent below that for May, 1926. All of the consuming industries reveal declines in May as compared with the preceding month and with the exception of dyeing and finishing textiles the comparison with May, 1926, is unfavorable. It is believed, however, that June and July returns will show up more favorably for the present year. For instance, crude rubber consumption in June was reported as 33,801 tons as against 28,599 tons in June, 1926.

With regard to the outlook in consuming trades, conditions at New England textile mills are reported to be improving. The price trend in hides and leather has been upward because of smaller stocks. The plate glass trade has applied for tariff assistance to curtail foreign competition and recent developments in the home industry have been in favor of reduced production costs. It also is reported that progress has been made in reducing the minimum thickness of glass which may open up new outlets. Makers of alcohol have worked off surplus stocks and have held production within consuming limits and are therefore in a position to take advantage of an increased demand especially as large stocks of molasses are reported to be available at reasonable prices.

THE OUTPUT or raw materials in May, according to the Department of Commerce, was larger than in April, being larger also than in May, 1926. As compared with a year ago, all classes of raw material were produced or marketed in greater quantities except forest products, which declined. Manufacturing production, after adjustments for differences in working time, showed an increase over both the preceding month and May of last year. As compared with April, industrial output showed gains, with no allowance for working time differences, in foodstuffs, textiles, lumber, chemicals and oils, stone and clay products, and tobacco, all other groups either declining or showing no change. As compared with last year, manufacturing production was greater in all groups except non-ferrous metals, lumber, paper and printing, and automobiles, which declined.

Stocks of commodities held at the end of May, after adjustments for seasonal variation, were larger than at the end of either previous month or May a year earlier. As compared with the preceding month, stocks of raw foodstuffs and manufactured foodstuffs were larger, while other raw materials for manufacture and other manufactured commodities showed declines. As compared with a year ago all commodity groups showed larger stocks except manufactured foodstuffs, which declined.

Unfilled orders for manufactured commodities, principally iron and steel and building materials, declined from the preceding month but showed no change from last year. As compared with the preceding month, iron and steel orders unfilled were smaller, while building materials were larger. As compared with a year ago, unfilled orders for iron and steel were likewise smaller in May, with building materials showing an advance.

EXPORTS of chemicals and related products valued at $18,053,000 in May, 1927, were the highest for any single month since monthly analyses were started. In fact, to date, the exports throughout the year have been high and for the five months attained a total of around $80,000,000. Imports on the other hand, have been running about average and those for May were valued at $17,500,000.

According to statistics of the Department of Commerce all the important groups in exports recorded gains over May, 1926; of the individual commodities, sulphur stood out with exceptionally large shipments of 135,000 tons. In the industrial chemical branch, the disinfectant and insecticide group, and the sodas, accounted for the quarter more exported in May, 1927, than in May, 1926. During May, over half a million dollars worth of disinfectants, insecticides, and fungicides were shipped abroad. In the soda group, the gains were general in nearly all classes with soda ash and sodium silicate making the largest.

In the pigment, paint, and varnish group, the most important increases occurred in carbon black and ready mixed paints. Varnishes, other than oil and including lacquers, also showed a promising trade.

Larger imports of crude materials not indigenous to the United States continued to be the noteworthy incidents in the incoming trade. Chief of these was the receipt of 13,103,000 lb. of Chinawood oil.

Decline in Imports of Synthetic Dyes

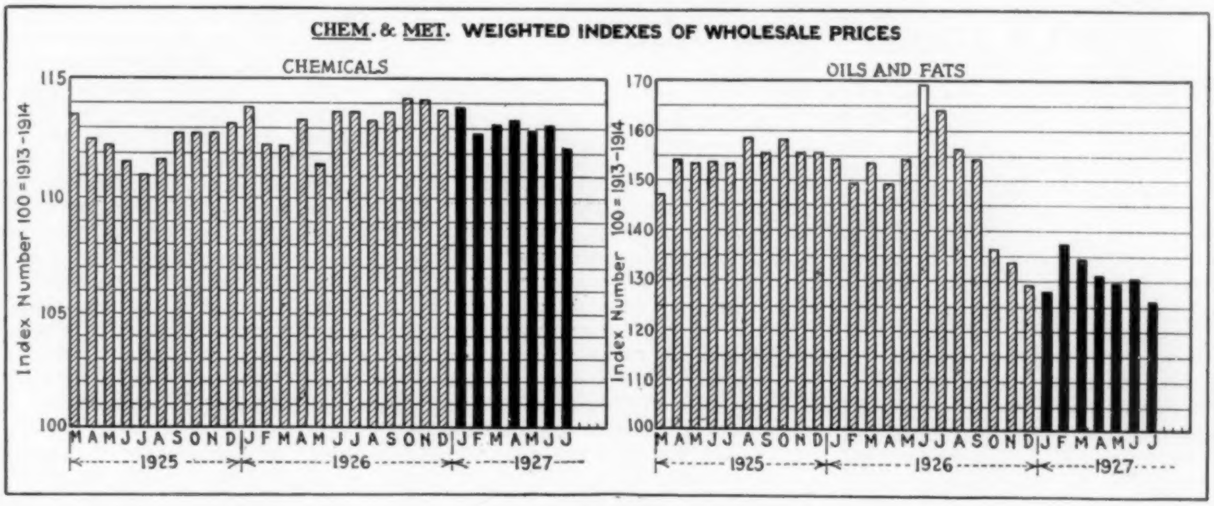
According to statistics compiled by the Bureau of Foreign and Domestic Commerce, importations of synthetic dyes for the first half of the year show a marked decline from the total reported for the first half of 1926. Imports, by months, were as follows:

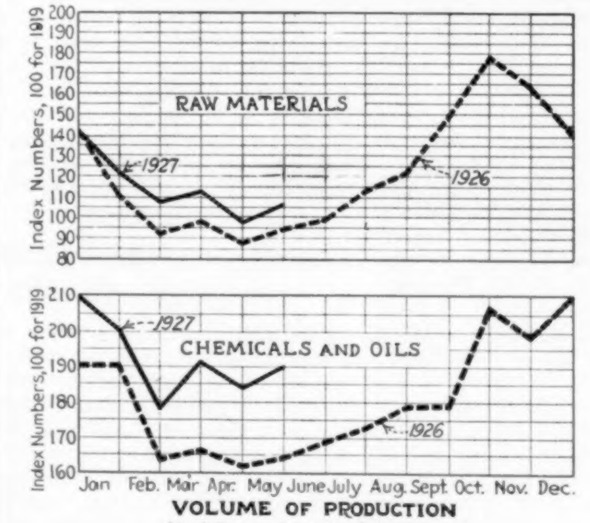
Imports of Synthetic Dyes

	1927 Lb.	1926 Lb.
January	196,620	300,441
February	312,277	369,045
March	404,714	487,804
April	402,783	437,526
May	349,476	392,739
June	318,450	333,319
Total 6 months	1,984,320	2,320,874

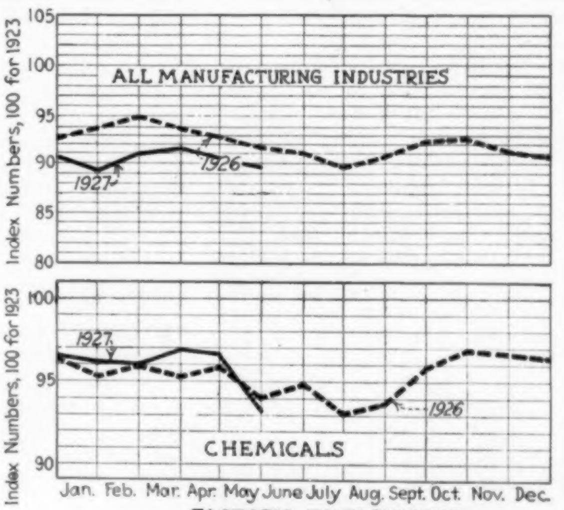
CHEM. & MET. STATISTICS OF BUSINESS

IN THE CHEMICAL ENGINEERING INDUSTRIES

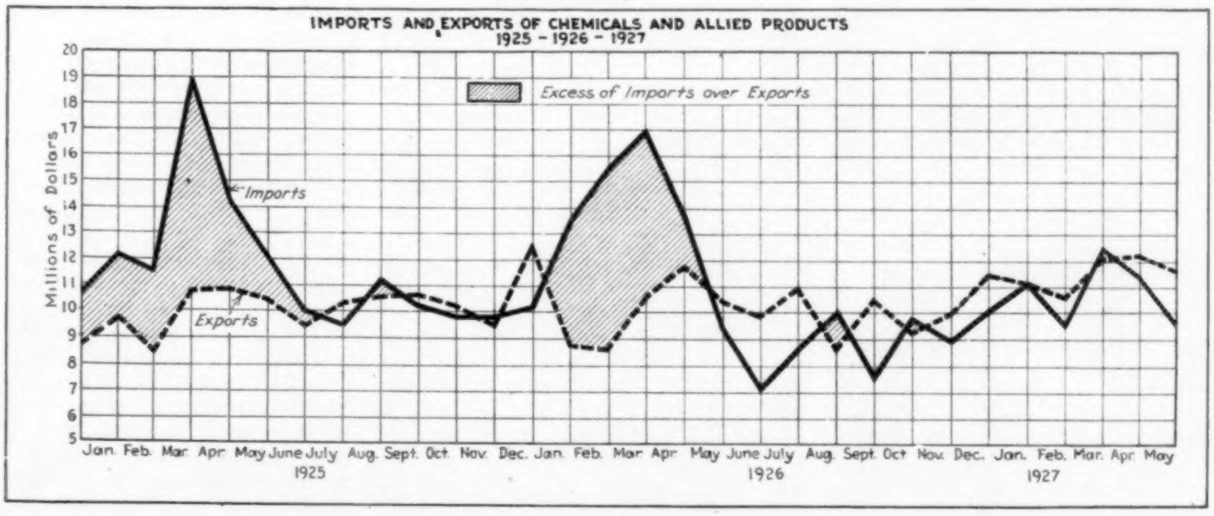




VOLUME OF PRODUCTION
(U.S. Department of Commerce)



FACTORY EMPLOYMENT
(U.S. Bureau of Labor Statistics)



MARKET CONDITIONS *and* PRICE TRENDS

Crop Reports Exert Wide Influence on Various Commodities

Cotton and Flaxseed Acreage Figures Offer Basis for Estimating Future Values for Oils and Fats

FIRST PRELIMINARY reports on the cotton and flaxseed acreages for the present season were issued by the Department of Agriculture, on July 9 and July 11, respectively. These reports had been awaited with interest not only by agriculturists and others directly connected with the production and sale of these products, but also by members of various consuming industries, to whom these reports presented the first tangible basis for estimating future supplies and future prices for many vegetable oils and fats.

THE COTTON report placed acreage at 42,683,000 as compared with 48,730,000 acres cultivated last year. This means that present acreage is but 87.6 per cent of last year's total. Outside of its significance to the textile trade, this report has a direct bearing on prospects for the coming fertilizer season. Smaller cotton production lessens the bearish influence of a large carryover from last season and brings supply and demand within closer proportions. Following the issuance of the report, values for cotton appreciated and higher returns from sales of the staple mean that planters will be in a better financial position to take on larger stocks of fertilizer. Hence fertilizer prospects have been greatly improved during the month.

Assuming that cottonseed production will be in direct proportion to that of cotton, it becomes evident that new crop supply of cottonseed oil will fall materially below that of the 1926-27 season. Interpreted in terms of price trends, this leads to the conclusion that higher average values will prevail for cottonseed oil for the next 12 months, the extent of advances depending on the present season carryover, the volume of new production, and the status of consuming demand. Disappearance of refined oil for the present crop year, August, 1926, through May, 1927, with comparisons for the preceding season, was as follows:

Disappearance of Refined Cotton Oil

	1926-27 Bbl.	1925-26 Bbl.
August	185,000	254,000
September	251,000	321,000
October	363,000	395,000
November	343,000	375,000
December	325,000	309,000
January	352,000	369,000
February	346,000	266,000
March	322,000	282,000
April	206,000	288,000
May	287,000	206,000
Totals	2,980,000	3,065,000

The visible supply of oil and seed on June 1 was 1,551,000, which, added to the total distributed through May, would give a total supply of 4,531,000 bbl. for the 1926-27 season. Of this total 396,000 bbl. represented carryover from the preceding season, hence 1926-27 production works out at 4,135,000 lb. If June and July consumption total 551,000 bbl. the carryover into next season will be 1,000,000 bbl. On the face of the cotton report, production of oil in the 1927-28 season would be approximately 12½ per cent less than in 1926-27 and would be represented by about 3,600,000 bbl. which the carryover would bring up to 4,600,000 bbl. This would mean an increased supply for 1927-28 and could not be construed as of bearish influence on prices. However, abandoned cotton acreage in the last 10 years has averaged 3.5 per cent of the planted area and yield per acre this season should be below average because of the decline of fertilizer consumption. Possibility of boll weevil damage, also is greater this season and indications point to a much smaller yield of cottonseed this season than is shown by the preliminary report on cotton acreage.

THE FLAXSEED report referred to the status of the growing crop as of July 1. It was disappointing inasmuch as acreage figures failed to come up to expectations but favorable conditions were revealed and an unusually high yield per acre was reported. The report, with comparisons for July, 1926, and 1925, was as follows:

Preliminary Flaxseed Report

	Acreage	Condition	Yield Per Acre	Total Yield
1927	2,653,000	86.3	8.1	21,600,000
1926	2,843,000	73.0	7.0	19,900,000
1925	3,486,000	81.6	7.5	26,100,000

With acreage figures pretty well established, total outturn will depend on weather conditions throughout the growing season. In any event, it will be necessary to import considerable quantities of seed and future prices for seed and oil will rest largely on world conditions of supply and demand. According to the Bureau of Census, domestic consumption of flaxseed in the calendar year 1926, was 1,092,076 tons or 35,431,000 bu. and in 1925, 1,155,384 tons or 41,265,000 bu. Production of linseed oil in those years was 720,109,940 lb. and 763,822,379 lb. with consumption 415,113,360 lb. and 413,942,837 lb. respectively. Stocks of oil on Dec. 31, 1925, were 155,846,898 lb. and 174,243,284 lb. on Dec. 31, 1926. As stocks of oil increased only 18,396,386 lb. during 1926, total disappearance was in excess of 700,000,000 lb. which figure may be regarded as representing present annual consuming requirements.

To round out domestic seed requirements, recourse is had largely to the Argentine. Shipments from the Argentine to this country from Jan. 1 to date were 11,808,000 bu. Total Argentine shipments to all countries for the same period were 46,572,000 bu. so that this country has been taking more than one-fourth of these shipments. The present Argentine crop is estimated at 62,600,000 bu. and if the next crop in that country approximates that amount there will be little fear of any world scarcity of seed or of any drastic upward movement to prices for linseed oil. American crushers' dependence on a foreign supply of seed makes it impossible to predicate future values on the information given in the current crop report. The fact that a good start has been made and weather conditions have been favorable is encouraging but on the acreage sown, a total yield equal to the consuming requirements of the country is out of the question and the course of prices later in the year undoubtedly will be governed by the position of outside markets, notably those of the Argentine.

Synthetic Methanol Offered in Larger Amounts

AS LONG as this country was a non-producer of synthetic methanol, offerings in the open market were limited because the greater part of arrivals from abroad were sold ahead and passed directly to consumers against existing contracts. Promise of a domestic production of this material was held out some time ago but it has been only recently that supplies have been in evidence in large volume either for contract or transient business. It is reported that difficulties have been encountered in the attempt to produce this material and that the scarcity of supplies was due to the inability of producers to get into actual operation. Some reports say that radical defects were uncovered in attempts to produce by certain processes. However, production has recently reached a stage where it commands attention as a market factor and declines in prices as reported some weeks ago were attributed to low priced offerings on the part of sellers of the domestic synthetic material. In connection with domestic production, considerable speculation has arisen relative to producing costs and to the limits of price reductions should it be necessary to meet keener competition. The opinion is held that domestic production is attained at very low costs which practically eliminate the possibility of foreign competition.

MARKET CONDITIONS *and* PRICE TRENDS

Producers of methanol from wood distillation appear to have curtailed outputs but denaturing grades are reported as steady in price. Statistics for methanol production in the wood distillation industry will be found in the accompanying table.

Production of Crude and Refined Methanol

	Crude	Crude — Stocks, end of month		Refined		
1926	Production, Gal.	At crude plants, Gal.	At refineries and in transit Gal.	Production, Gal.	Shipments or consumption, Gal.	Stocks end of month, Gal.
January	752,292	1,400,994	656,565	642,397	....	717,817
February	683,707	1,176,337	685,995	532,309	....	727,244
March	738,958	1,280,625	750,480	607,586	....	655,382
April	764,670	1,474,624	850,999	577,885	....	723,426
May	671,674	1,414,577	876,428	523,766	....	685,000
Total	3,611,301	....	....	2,883,943	....	....
June	564,596	1,165,016	600,780	698,919	....	645,123
July	553,050	888,923	279,202	737,704	....	709,639
August	589,828	622,456	351,409	608,346	....	516,943
September	610,393	486,199	164,363	700,211	....	463,488
October	712,309	442,998	151,326	618,284	....	379,710
November	720,798	463,049	144,136	623,544	....	331,256
December	733,678	(1) 278,219	207,682	531,764	527,716	284,754
Total for year	8,095,953	....	....	7,402,715	527,716	....
1927						
January	755,473	(1) 397,999	341,444	488,037	374,530	436,656
February	630,583	(1) 340,847	613,939	311,583	337,428	426,736
March	676,694	(1) 420,930	645,852	575,978	411,114	597,379
April	616,738	(1) 325,888	819,216	425,510	416,996	606,975
May	588,376	(1) 345,366	896,334	431,470	469,513	554,313
Total	3,267,864	....	....	2,232,578	2,009,581	....

Imports of Chemicals

	May 1927	May 1926
Dead or creosote oil, gal	14,276,498	6,471,658
Pyridine, lb	16,705	47,480
Coal-tar acids, lb	16,686	49,298
Coal-tar intermediates, lb	163,762	54,125
Arsenic, lb	6,510,541	1,066,137
Acid, citric, lb	11,872	2,240
Acid, formic, lb	235,947	258,489
Acid, oxalic, lb	207,544	167,912
Acid, sulphuric, lb	6,264,996	3,931,570
Acid, tartaric, lb	187,488	86,481
Ammonium chloride, lb	1,064,575	905,971
Ammonium nitrate, lb	1,391,725	696,915
Barium compounds, lb	1,799,549	3,580,601
Calcium carbide, lb	377,510	930,414
Cobalt oxide, lb	45,250	18,200
Copper sulphate, lb	60,785	109,210
Bleaching powder, lb	261,026	186,380
Lime citrate, lb	....	444,262
Glycerine, crude, lb	999,288	1,348,955
Glycerine, refined, lb	1,197,304	319,399
Magnesium compounds, lb	1,722,678	1,523,605
Potassium cyanide, lb	13,448	16,611
Potassium carbonate, lb	1,227,863	1,272,033
Potassium nitrate, ton	210	3,532
Caustic potash, lb	1,152,106	1,362,880
Cream of tartar, lb	33,246	44,799
Potassium chlorate, lb	1,025,422	1,531,283
Sodium cyanide, lb	3,000,546	2,475,740
Sodium ferrocyanide, lb	135,178	108,669
Sodium nitrite, lb	47,491	247,754
Sodium nitrate, ton	43,578	58,082
Sulphate of ammonia, ton	186	1,13[illegible]

Exports of Chemicals

	May 1927	May 1926
Benzol, gal	1,885,821	1,417,793
Crude coal-tar and pitch, bbl.	47,569	7,224
Acid, sulphuric, lb	729,771	1,126,993
Other acids, lb	471,215	812,334
Methanol, gal	22,863	16,001
Ammonia and compounds, lb	396,019	360,078
Aluminum sulphate, lb	3,380,777	4,220,448
Acetate of lime, lb	1,581,661	1,893,375
Calcium carbide, lb	337,586	422,087
Bleaching powder, lb	4,103,777	1,975,797
Copper sulphate, lb	328,715	246,383
Formaldehyde, lb	229,741	182,171
Potassium compounds, lb	284,415	632,087
Sodium bichromate, lb	911,935	395,238
Sodium cyanide, lb	137,455	58,972
Borax, lb	4,600,459	2,487,724
Soda ash, lb	4,478,022	3,376,722
Sodium silicate, lb	4,918,804	3,997,242
Sal soda, lb	1,062,793	1,107,633
Caustic soda, lb	9,284,047	8,280,084
Bicarbonate of soda, lb	1,811,566	1,700,487
Sulphate of ammonia, ton	17,386	11,101
Sulphur, ton	135,149	30,304

Legislation for Chilean Nitrate Industry

CHIEF INTEREST in the nitrate of soda trade has centered in developments in primary points. A bill has been introduced in Chile, which, in its original form, practically would nationalize the industry. At first it was proposed that the Chilean government have the power to expropriate as of public utility the oficinas, plants, and in general every establishment or business connected with the nitrate industry. This bill was modified by the Chamber of Deputies.

The bill creating a superintendency of nitrates and iodine recently approved by the mixed congressional committee passed the Chamber of Deputies with only slight changes and the Senate will discuss it during the week of June 27, states a cable from Commercial Attache Ralph H. Ackerman, Santiago. Among other provisions the bill held the nitrate and iodine industries to be public utilities and grants the government the right to expropriate water rights and pipe lines; roads, railways, and railway equipment; piers, wharves, and any other privately owned maritime shipping equipment in the nitrate zone.

Also the government may take the initiative in organizing sales of nitrate after July 1, 1928, and the superintendent may require payment at par of the taxes in nitrate, at cost, up to the total of domestic annual consumption. . . . The bill provides further for the creation of a nitrate loan institution, and the government may aid the industry up to a sum of 100,000,000 pesos, and empowers the President to reduce freight rates on nitrate railways of coal, petroleum and nitrate.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	112.23
Last month	112.83
July, 1926	113.33
July, 1925	110.97

With the exception of some shading of quotations, price changes were not numerous during the month. The weighted number, however, was affected by reduced prices for sulphate of ammonia and miscellaneous chemicals. Lead oxides continued to seek lower levels.

Reduced Supplies Strengthen Shellac Prices

WHILE there has been an up and down movement in prices for shellac in the last two weeks, the general trend of values has been upwards. Early in the year demand for shellac, here and in European markets, was quiet and factors in Calcutta fixed minimum prices in order to check declines and also closed factories in March in order to help stabilize the market. Even at that time indications pointed to a smaller crop for the new season in some of the large producing sections. In May, advices from India stated that the Bysacki crop then ready for market was the smallest on record for several years. The shortage was due to the intense heat of last year killing the brood lac. It is predicted for the same reason that the next crop will show a decrease in the number of brood lac. The present crop will amount to approximately 13,200,000 lbs. and if released, there will be available 825,000 lb. per month for shipments during August, September, October and November. An increase of one third in price followed.

Lac is obtained in India from four main areas, the Central India Area, Sind, Central Assom and Upper Burma, although there is sporadic cultivation elsewhere, as in the Punjab and Mysore. The principal factories are situated in the United Provinces and Bihar. There are also two factories in Calcutta where shellac is manufactured by special processes on a considerable scale.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	126.20
Last month	130.07
July, 1926	164.71
July, 1925	153.07

While the position of crude cottonseed oil has been firmer the general price trend for oils and fats has been downward. Lower prices prevailed for linseed, palm, and china wood oils and tallow, oleo oil, and glycerine also declined in value.

CURRENT PRICES in the NEW YORK MARKET

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to July 18.

Industrial Chemicals

		Current Price	Last Month	Last Year
Acetone, drums	lb.	$0.12 -$0.13	$0.12 -$0.13	$0.12 -$0.13
Acid, acetic, 28%, bbl.	cwt.	3.38 - 3.63	3.38 - 3.63	3.25 - 3.50
Boric, bbl	lb.	.08½- .08¾	.08½- .08¾	.08½- .11
Citric, kegs	lb.	.44½- .45	.43½- .47	.45 - .47
Formic, bbl	lb.	.10½- .11	.10½- .11	.10½- .11
Gallic, tech., bbl	lb.	.50 - .55	.50 - .55	.45 - .50
Hydrofluoric 30% carb.	lb.	.06 - .07	.06 - .07	.06 - .07
Lactic, 44%, tech., light, bbl.	lb.	.13½- .14	.13½- .14	.13½- .14
22%, tech., light, bbl.	lb.	.06½- .07	.06½- .07	.06½- .07
Muriatic, 18°, tanks	cwt.	.85 - .90	.85 - .90	.85 - .90
Nitric, 36°, carboys	cwt.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks.	ton	18.00 -20.00	18.00 -20.00	18 00- 20.00
Oxalic, crystals, bbl.	lb.	.11 - .11½	.11 - .11½	.10½- .11
Phosphoric, tech., c'bys.	lb.	.07 - .07½	.07 - .07½	.07 - .07½
Sulphuric, 60°, tanks	ton	10.50 -11.00	10.50 -11.00	10.50 -11.00
Tannic, tech., bbl	lb.	.35 - .40	.35 - .40	.35 - .40
Tartaric, powd., bbl	lb.	.37 - .37½	.33 - .34	.29 - .30
Tungstic, bbl	lb.	1.00 - 1.20	1.00 - 1.20	1.00 - 1.20
Alcohol, ethyl, 190 p'f. U.S.P. bbl	gal.	3.75 - 4.00	3.75 - 4.00	4.90 - 5.00
Alcohol, Butyl, dr.	lb.	.19½- .20½	.20 - .20½	.18½- .19
Denatured, 190 proof				
No. 1 special dr.	gal.	.46½-......	.46½	.28 -......
No. 5, 188 proof, dr.	gal.	.44 -......	.44	.28 - .32
Alum, ammonia, lump, bbl.	lb.	.03½- .04	.03½- .04	.03½- .04
Chrome, bbl	lb.	.05½- .05¾	.05½- .05¾	.05½- .06
Potash, lump, bbl	lb.	.02¾- .03½	.02¾- .03½	.02¾- .03½
Aluminum sulphate, com., bags	cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg	cwt.	2.00 - 2.10	2.00 - 2.10	2.40 - 2.45
Aqua ammonia, 26°, drums.	lb.	.02½- .03	.02½- .03½	.03½- .04
Ammonia, anhydrous, cyl.	lb.	.11 - .13	.11 - .15	.13 - .15
Ammonium carbonate, powd. tech., casks	lb.	.10½- .14	.10½- .14	.11 - .14
Sulphate, wks.	cwt.	2.25 -......	2.45 -......	2.55 -......
Amylacetate tech., drums	gal.	2.15 - 2.20	2.15 - 2.20	1.80 - 1.90
Antimony Oxide, bbl.	lb.	.16 - .16½	.16 - .17½	.14½- .15
Arsenic, white, powd., bbl.	lb.	.03¾- .04½	.03½- .04½	.03¾- .04½
Red, powd., kegs	lb.	.08¾- .10	.08¾- .10	.11 - .12
Barium carbonate, bbl.	ton	50.00 -52.00	50.00 -52.00	48.00 -50.00
Chloride, bbl.	ton	58.00 -60.00	58.00 -60.00	63.00 -65.00
Nitrate, cask	lb.	.08 - .08½	.07½- .08½	.07½- .08
Blanc fixe, dry, bbl	lb.	.04 - .04½	.04 - .04½	.03¾- .04
Bleaching powder, f.o.b., wks., drums	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, bbl.	lb.	.04½- .04¾	.04½- .05	.05 - .05½
Bromine, cs.	lb.	.45 - .47	.45 - .47	.45 - .47
Calcium acetate, bags	cwt.	3.50 -......	3.50 -......	3.25 - 3.50
Arsenate, dr.	lb.	.07½- .08	.06½- .07	.06 - .07
Carbide drums	lb.	.05 - .06	.05½- .06	.05½- .06
Chloride, fused, dr., wks.	ton	21.00 -......	21.00 -......	21.00 -......
Phosphate, bbl.	lb.	.07 - .07½	.07 - .07½	.07 - .07½
Carbon bisulphide, drums	lb.	.05½- .06	.05½- .06	.05½- .06
Tetrachloride drums	lb.	.06¾- .07	.06½- .07	.06¾- .07
Chlorine, liquid, tanks, wks.	lb.	.04 - .04½	.04 - .04½	.04 - .04½
Cylinders	lb.	.05½- .08	.05½- .08	.05½- .08
Cobalt oxide, cans	lb.	2.00 - 2.10	2.00 - 2.10	2.10 - 2.25
Copperas, bgs., f.o.b. wks.	ton	14.00 -17.00	14.00- 17.00	15.00 -18.00
Copper carbonate, bbl	lb.	.17 - .17½	.17 - .18	.16½- .17
Cyanide, tech., bbl	lb.	49 - .50	.49 - .50	.49 - .50
Sulphate, bbl.	cwt.	4.90 - 5.00	4.80 - 4.90	4.75 - 5.00
Cream of tartar, bbl.	lb.	.27½- .28	.22 - .22½	.21 - .22
Epsom salt, dom., tech., bbl.	cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags	cwt.	1.15 - 1.25	1.15 - 1.25	1.35 - 1.40
Ethyl acetate, 85% drums	gal.	.74 - .76	.74 - .76	.80 - .82
99%, dr.	gal.	.95 - .96	.95 - .96	1.01 - 1.06
Formaldehyde, 40%, bbl	lb.	.11½- .11½	.11½- .11½	.09 - .09½
Furfural, dr.	lb.	.15 - 17½	.15 - .17½	.15 - .17
Fusel oil, crude, drums	gal.	1 30 - 1.40	1.35 - 1.40	1.40 - 1.50
Refined, dr	gal.	2.50 - 3.00	2.50 - 3.00	2.50 - 3.00
Glaubers salt, bags	cwt.	1.00 - 1.15	1.00 - 1.10	1.20 - 1.40
Glycerine, c.p., drums, extra.	lb.	.24½- .25	.26 - .26½	.27½-......
Lead:				
White, basic carbonate, dry, casks	lb.	.09 -......	.09 -......	.10½-......
White, basic sulphate, sck.	lb.	.08½-......	.08½-......	.09½-......
Red, dry, sck	lb.	.09¾-......	.10 -......	.12 -......
Lead acetate, white crys., bbl.	lb.	.13 - .13½	.14½- .15	.14½-......
Lead arsenate, powd., bbl	lb.	.12 - .13	.14 - .15	.14 - .15
Lime, chem., bulk	ton	8.50 -......	8.50 -	8.50 -......
Litharge, pwd., csk	lb.	.08½-......	.09 -	.11½-......
Lithopone, bags	lb.	.05½- .06	.05½- .06	.05½- .06½
Magnesium carb., tech., bags.	lb.	.07½- .08	.07½- .08	.06 - .06½
Methanol, 95%, dr.	gal.	.66 -......	.83 - .85	.55 - .58
97%, dr.	gal.	.68 - .70	.85 - .90	.57 - .62
Nickel salt, double, bbl.	lb.	.10 - .10½	.10 - .10½	.09 - .10
Single, bbl	lb.	.10½- .11	.10½- .11	.10 - .11
Orange mineral, csk.	lb.	.11½-......	.11½-......	.14 -......
Phosphorus, red, cases	lb.	.62 - .65	.62 - .65	.65 - .68
Yellow, cases	lb.	.32 - .33	.32 - .34	.33 - .34
Potassium bichromate, casks.	lb.	.08½- .08¾	.08½- .08¾	.08½- .08¾
Carbonate, 80-85%, calc., csk.	lb	.05½- .06	.06 -......	.06 - .06½
Chlorate, powd.	lb.	.08½- .09	.08½- .09	.08½- .09
Cyanide, cs.	lb.	.55 - .57	.55 - .58	.55 - .57
First sorts, csk.	lb.	$0.09 -$0.09½	$0.08½-$0.09	$0.08½-$0.09
Hydroxide (c'stic potash) dr.	lb.	.07½- .07¾	.07½- .07¾	.07½- .07½
Muriate, 80% bgs	ton	36.40 -......	36.40 -......	34.90 -......
Nitrate, bbl.	lb.	.06 - .06½	.06 - .06½	.06 - .07½
Permanganate, drums	lb.	.14 - .15	.14 - .15	.14½- .15
Prussiate, yellow, casks	lb.	.18½- .19	.18½- .19	.18½- .19
Sal ammoniac, white, casks.	lb.	.05½- .06	.05½- .06½	.05½- .06
Salsoda, bbl.	cwt.	.90 - .95	.90 - .95	.06½- .06½
Salt cake, bulk	ton	17.00 -18.00	17.00 -18.00	17.00 -19.00
Soda ash, light, 58%, bags, contract	cwt.	1.32½-......	1.32½-......	1.38 -......
Dense, bags	cwt.	1.37½-......	1.37½- 1.55	1.45 - 1.55
Soda, caustic, 76%, solid, drums, contract	cwt.	3.00 -......	3.00 -......	3.10 -......
Acetate, works, bbl.	lb.	.04½- .05½	.04½- .05	.04½- .05
Bicarbonate, bbl.	cwt.	2.00 - 2.25	2.00 - 2.25	2.00 - 2.25
Bichromate, casks	lb.	.06½- .06¾	.06½- .06¾	.06½- .06¾
Bisulphate, bulk	ton	5.00 - 5.50	5.00 - 5.50	6.00 - 7.00
Bisulphite, bbl.	lb.	.03½- .04	.03½- .04	.03½- .04
Chlorate, kegs	lb.	.06½- .06½	.06½- .06½	.06½- .06½
Chloride, tech.	ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom.	lb.	.18 - .22	.18 - .22	.19 - .22
Fluoride, bbl.	lb.	.08½- .09	.09½- .10	.08½- .09
Hyposulphite, bbl.	lb.	2.50 - 3.00	2.50 - 3.00	2.65 - 3.00
Nitrate, bags	cwt.	2.50 -......	2 65 -......	2.57½-......
Nitrite, casks	lb.	.08½- .08½	.08 - .08½	.08½- .09
Phosphate, dibasic, bbl.	lb.	.03½- .03½	.03½- .03¾	.03½- .03¾
Prussiate, yel. drums	lb.	.12 - .12½	.12 - .12½	.10½- .10½
Silicate (30°, drums)	cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr.	lb.	.03½- .04	.03 - .03½	.02½- .03
Sulphite, crys., bbl	lb.	.03 - .03½	.03 - .03½	.02½- .03
Strontium nitrate, bbl.	lb.	.08½- .09	.08½- .09	.08½- .09
Sulphur, crude at mine, bulk.	ton	19.00 -......	19.00 -......	19.00 -20.00
Chloride, dr	lb.	.04 - .05	.04 - .05	.05 - .05½
Dioxide, cyl	lb.	.09 - .10	.09 - .10	.09 - .10
Flour, bag	cwt.	2.70 - 3.00	2.70 - 3.00	2.70 - 3.00
Tin bichloride, bbl.	lb.	.19½-......	.19½-......	.17 -......
Oxide, bbl.	lb.	.69 -......	.69 -......	.64 -......
Crystals, bbl.	lb.	.47 -......	.47 -......	.41½-......
Zinc chloride, gran., bbl.	lb.	.06½- .06½	.06½- .06½	.07 - .07½
Carbonate, bbl.	lb.	.10 - .11	.10 - .10½	.10½- .11
Cyanide, dr.	lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl.	lb.	.10½- .11	.10½- .11	.09 - .10
Zinc oxide, lead free, bag.	lb.	.06½-......	.06½-......	.07½-......
5% lead sulphate, bags	lb.	.06½-......	.06½-......	07½-......
Sulphate, bbl	cwt.	2.75 - 3 00	2.75 - 3.00	2 75 - 3 00

Oils and Fats

		Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.	lb.	$0.12½-$0.13	$0.13½-$0.14½	$0.12½-$0.13
Chinawood oil, bbl.	lb.	.19 -......	.20 -......	.12½- .13
Coconut oil, Ceylon, tanks, N. Y.	lb.	.08½-......	.08½-......	.10½-......
Corn oil crude, tanks, (f.o.b. mill)	lb.	.11 -......	.08½-......	.13 -......
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08½-......	.08 -......	.14 -......
Linseed oil, raw, car lots, bbl.	lb.	10.6 -......	11.2 -......	11.03 -......
Palm, Lagos, casks	lb.	.07½-......	.07½- .08	.09 -......
Niger, casks	lb.	.07½-......	.07½- .07½	.08½-......
Palm Kernel, bbl.	lb.	.08½-......	.08½-......	.10½-......
Peanut oil, crude, tanks (mill)	lb.	.12½-......	.12½-......	.12½-......
Perilla, bbl	lb.	....-......	....-......	....-......
Rapeseed oil, refined, bbl.	gal.	.78 - .80	.80 - .82	.89 - .91
Sesame, bbl.	lb.	....-......	....-......	....-......
Soya bean tank (f.o.b. Coast)	lb.	.09½-......	.09½-......	.10½-......
Sulphur (olive foots), bbl.	lb.	.08½-......	.09½-......	.08½-......
Cod, Newfoundland, bbl	gal.	.63 - .66	.63 - .64	.60 - .65
Menhaden, light pressed, bbl.	gal.	.60 - .62	.60 - .62	.65 - .68
Crude, tanks (f.o.b. factory)	gal.	....-......	....-......	.47½-......
Whale, crude, tanks	lb.	....-......	....-......	....-......
Grease, yellow, loose	lb.	.06½-......	.06½-......	.08½-......
Oleo stearine	lb.	.09½-......	.09½-......	.14 -......
Red oil, distilled, d.p. bbl.	lb.	.09½- .09½	.09½- .10	.10 - .10½
Tallow, extra, loose	lb.	.07½-......	.07½-......	.09 -......

Coal-Tar Products

		Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl.	lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl	lb.	.85 - .90	.85 - .90	.85 - .90
Alpha-naphthylamine, bbl.	lb.	.35 - .36	.35 - .36	.35 - .36
Aniline oil, drums, extra	lb.	.15 - .16	.15 - .16	.16 - .16½
Aniline salts, bbl	lb.	.24 - .25	.24 - .25	.22 - .23
Anthracene, 80%, drums	lb.	.60 - .65	.60 - .65	.60 - .65

Coal Tar Products (Continued)

	Current Price	Last Month	Last Year
Benzaldehyde, U.S.P., dr.... lb.	$1.15 -$1.25	$1.15 -$1.35	$1.30 -$1.35
Benzidine base, bbl.......... lb.	.70 - .72	.70 - .75	.72 - .74
Benzoic acid, U.S.P., kgs.... lb.	.58 - .60	.58 - .60	.56 - .60
Benzyl chloride, tech, dr.... lb.	.25 - .26	.25 - .26	.25 - .26
Benzol, 90%, tanks, works... gal.	.24 - .25	.24 - .25	.25 - .26
Beta-naphthol, tech., drums. lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U.S.P., dr........... lb.	.18 - .20	.18 - .20	.18 - .20
Cresylic acid, 97%, dr., wks. gal.	.61 - .62	.61 - .62	.60 - .65
Diethylaniline, dr........... lb.	.58 - .60	.58 - .60	.58 - .60
Dinitrophenol, bbl........... lb.	.31 - .35	.31 - .33	.31 - .35
Dinitrotoluen, bbl........... lb.	.17 - .18	.17 - .18	.18 - .20
Dip oil, 25% dr.............. gal.	.28 - .30	.28 - .30	.28 - .30
Diphenylamine, bbl........... lb.	.45 - .47	.45 - .47	.48 - .50
H-acid, bbl.................. lb.	.63 - .65	.63 - .65	.65 - .66
Naphthalene, flake, bbl...... lb.	.04½- .05	.05½- .06	.06½- .07
Nitrobenzene, dr............. lb.	.09 - .10	.09 - .10	.09 - .10
Para-nitraniline, bbl........ lb.	.52 - .53	.45 - .50	.50 - .53
Para-nitrotoluine, bbl....... lb.	.28 - .32	.28 - .32	.40 - .42
Phenol, U.S.P., drums........ lb.	.17 - .19	.17 - .19	.22 - .24
Picric acid, bbl............. lb.	.30 - .40	.30 - .40	.25 - .26
Pyridine, dr................. lb.	3.00 -......	3.00 -......	3.90 - 4.00
R-salt, bbl.................. lb.	.47 - .50	.40 - .44	.50 - .55
Resorcinal, tech, kegs....... lb.	1.30 - 1.35	1.35 - 1.40	1.30 - 1.40
Salicylic acid, tech., bbl... lb.	.30 - .32	.30 - .32	.32 - .33
Solvent naphtha, w.w.,tanks.gal.	.35 -......	.35 -......	.35 -......
Tolidine, bbl................ lb.	.95 - .95	.95 - .96	.90 - .95
Toluene, tanks, works....... gal.	.35 -......	.35 -......	.35 -......
Xylene, com., tanks.......... gal.	.36 - .41	.36 - .41	.36 - .40

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl..... ton	$23.00-$25.00	$23.00-$25.00	$23.00-$25.00
Casein, tech., bbl............ lb.	.17½- .18	.17½- .18	.13½- .14
China clay, dom.,f.o.b. mine ton	10.00 -20.00	10.00 -20.00	10.00 -20.00
Dry colors:			
Carbon gas, black (wks.)... lb.	.06½- .07	.06½- .07	.08 - .08½
Prussian blue, bbl........ lb.	.33 - .34	.33 - .34	.32 - .33
Ultramine blue, bbl....... lb.	.08 - .35	.08 - .35	.08 - .35
Chrome green, bbl......... lb.	.27 - .31	.28 - .30	.28 - .30
Carmine red, tins......... lb.	5.50 - 5.75	5.00 - 5.10	5.10 - 5.85
Para toner................ lb.	.80 - .90	.80 - .90	.90 - .95
Vermilion, English, bbl... lb.	1.80 - 1.85	1.80 - 1.85	1.45 - 1.50
Chrome yellow, C. P., bbl. lb.	.17 - .18	.17½- .18	.17½- .18
Feldspar, No. 1 (f.o.b. N. C.) ton	5.75 - 7.00	6.50 - 7.00	6.00 - 6.50
Graphite, Ceylon, lump, bbl. lb.	.07½- .08	.07 - .09½	.09 - .10
Gum copal, Congo, bags..... lb.	.09½- .10	.09½- .10	.09½- .10
Manila, bags.............. lb.	.15 - .18	.15 - .16	.14 - .10
Damar, Batavia, cases..... lb.	.25 - .25½	.25 - .26	.25 - .25
Kauri, No. 1 cases........ lb.	.55 - .57	.55 - .57	.58 - .62
Kieselguhr (f.o.b. N. Y.).... ton	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc.............. ton	44.00 -......	44.00 -......	38.00 -42.00
Pumice stone, lump, bbl..... lb.	.05 - .07	.05 - .08	.04½- .06
Imported, casks........... lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H..................... bbl.	10.00 -......	10.45 -......	14.50 -......
Turpentine.................. gal.	.57 -......	.60½-......	.87 -......
Shellac, orange, fine, bags... lb.	.52 - .53	.52 - .53	.40 - .41
Bleached, bonedry, bags... lb.	.59 - .61	.59 - .61	.43 - .44
T. N. bags................ lb.	.40 - .45	.42 - .44	.32 - .34
Soapstone (f.o.b. Vt.), bags.. ton	10.00 -12.00	10.00 -12.00	9.00 -11.00
Talc, 200 mesh (f.o.b. Vt.)... ton	10.50 -......	11.00 -......	10.50 -......
200 mesh (f.o.b. Ga.)...... ton	7.50 -10.00	7.50 -10.00	7.50 -11.00
325 mesh (f.o.b. N. Y.).... ton	13.75 -......	14.75 -......	14.75 -......

	Current Price	Last Month	Last Year
Wax, Bayberry, bbl.......... lb.	$0.25 -$0.26	$0.25 -$0.26	$0.20 -$0.21
Beeswax, ref., light........ lb.	.45 - .46	.45 - .47	.46 - .47
Candelilla, bags............ lb.	.33 - .34	.34 - .35	.36 - .37
Carnauba, No. 1, bags....... lb.	.65 - .70	.70 - .72	.48 - .50
Paraffine, crude 105-110 m.p.......... lb	.05½- .06	.06 - .06½	.05½- .06

Ferro-Alloys

	Current Price	Last Month	Last Year
Ferrotitanium, 15-18%...... ton	$200.00-.....	$200.00-.....	$200.00-.....
Ferrochromium, 1-2%........ lb.	.23- .25	.23- .35	.23- .
Ferromanganese, 78-82%..... ton	90.00-.....	88.00-90.00	88.00-90.00
Spiegeleisen, 19-21%....... ton	34.00-35.00	36.00-37.00	33.00-34.00
Ferrosilicon, 10-12%....... ton	33.00-38.00	33.00-38.00	33.00-38.00
Ferrotungsten, 70-80%...... lb.	.95- 1.00	1.00- 1.05	1.05- 1.10
Ferro-uranium, 35-50%...... lb.	4.50-.....	4.50-.....	4.50-.....
Ferrovanadium, 30-40%...... lb.	3.15- 3.75	3.25- 4.00	3.25- 3.75

Non-Ferrous Metals

	Current Price	Last Month	Last Year
Copper, electrolytic......... lb.	$0.12⅞-......	$0.12⅞-......	$0.13⅜-......
Aluminum, 96-99%............ lb.	.26 -$0.28	.26 -$0.27	.27 -$0.28
Antimony, Chin. and Jap..... lb.	.12 - .12¼	.12 - .12¼	.19½-......
Nickel, 99%................. lb.	.35 -......	.35 -......	.35 -......
Monel metal, blocks......... lb.	.32 - .33	.32 - .33	.32 - .33
Tin, 5-ton lots, Straits.... lb.	.68½-......	.67½-......	.59⅞-......
Lead, New York, spot........ lb.	6.20 -......	6.40 -......	7.80 -......
Zinc, New York, spot........ lb.	6.57 -......	6.57 -......	7.45 -......
Silver, commercial.......... oz.	.57⅜-......	.57⅜-......	.65½-......
Cadmium..................... lb.	.60 -......	.60 -......	.60 -......
Bismuth, ton lots........... lb.	2.20 - 2.25	2.20 - 2.25	2.70 - 2.75
Cobalt...................... lb.	2.50 -......	2.50 -......	2.50 - 3.00
Magnesium, ingots, 99%...... lb.	.75 - .80	.75 - .80	.75 - .80
Platinum, ref............... oz.	86.00-......	86.00-......	105.00-......
Palladium, ref.............. oz.	59.00- 63.00	59.00- 63.00	78.00-......
Mercury, flask.......... 75 lb.	117.00-......	117.00-......	91.25-......
Tungsten powder............. lb.	1.05- 1.15	1.05-......	1.18-......

Ores and Semi-finished Products

	Current Price	Last Month	Last Year
Bauxite, crushed, wks....... ton	$5.50- $8.50	$5.50- $8.50	$5.50- $8.75
Chrome ore, c.f. post....... ton	22.00- 24.00	21.00- 24.00	22.00- 23.00
Coke, fdry., f.o.b. ovens... ton	3.75- 4.25	3.75- 4.25	3.75- 4.25
Fluorspar, gravel, f.o.b. Ill... ton	17.00- 18.00	18.00-......	18.00-......
Ilmenite, 52% TiO_2, Va..... lb.	.0⅜- .0½	.0⅜ - .0½	.01½-......
Manganese ore, 50% Mn., c.i.f. Atlantic Ports....... unit	.36 - .38	.36 - .38	.40 - .42
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y........... lb.	.48 - .50	.48 - .50	.65- .70
Monazite, 6% of ThO_2..... ton	120.00-......	120.00-......	120.00-......
Pyrites, Span. fines, c.i.f..... unit	.13½-......	.13½-......	.13½-......
Rutile, 94-96% TiO_2........ lb.	.11 - .13	.11 - .13	.12 - .15
Tungsten, scheelite, 60% WO_3 and over....... unit	11.25 -11.50	11.25 -11.50	12.50 -13.00
Vanadium ore, per lb. V_2O_5.. lb.	.25 - .28	.25 - .30	.30 - .35
Zircon, 99%................. lb.	.03 -......	.03 -......	.03 -......

CURRENT INDUSTRIAL DEVELOPMENTS

New Construction and Machinery Requirements

Automatic Machines for Chlorine Control—City Health Department, Coral Gables, Fla., plans to install three automatic machines for the control of chlorine in the water at the three pumping stations. Address Dr. A. F. Allen, Health Department.

Battery Service—The Toronto Battery Service Co., 21 McCaul St., Toronto, Ont., Can., awarded contract for the construction of a 2 story, 62 x 126 ft. battery service building on Bay St., Toronto, to Harry Jennings, 49 St. Clair St., W., Toronto. Estimated cost $150,000.

Brass Factory — The American Brass Mfg. Co., J. Arth, Pres., 1525 East 49th St., Cleveland, O., had plans prepared for the construction of a 2 story, 20 x 70 ft. addition to brass factory. Estimated cost $40,000. Private plans. Six buffing and polishing machines will be required.

Brass Foundry—Hills-McCanna Co., 2025 Elston Ave., Chicago, Ill., awarded contract for the construction of two 1 story, 60 x 200 ft. factory buildings for foundry at Western Avenue and Nelson St., Chicago, to John Hammond Co., 2034 Flournoy St., Chicago, Ill.

Brewery Addition—The Huether Brewing Co., 476 King St., W., Kitchener, Ont., Can., plans to construct addition and install additional equipment for increasing its output, consisting of vats, bottling equipment and general brewery equipment. Estimated cost $50,000. J. C. Klaehn, 129 King St., W., Kitchener, is engineer.

Brewery — Rock Brewery Co., Preston, Ont., Can., awarded the contract for the construction of a 2 story brewery on Brown St., to Frid Construction Co., 6 Hughson St., North Hamilton, Ont. Estimated cost $100,000. Complete brewing cooling equipment, vats, etc., will be required.

Candy Factory—The Daggett Chocolate Co., 408 Main St., Cambridge, Mass., awarded contract for the construction of a 6 story, 100 x 165 ft. candy factory at 38-44 Ames St. to Wm. H. Bailey Co., 88 Broad St., Boston. Estimated cost $152,000.

Cannery—Quality Canners Ltd, Windsor, Ont., plans the construction of a cannery at Newbury, Ont. Estimated cost $60,000. Equipment will be required.

Canning Factory, etc.—J. E. Rice, Main St., Marlboro, Mass., is receiving bids for the construction of a 1 story fruit canning factory and cider mill on Northboro Rd., Marlboro. Estimated cost $40,000. J. F. Bigelow, 64 Highland St., Marlboro, is architect.

Canning Plant and Warehouse—California Co-Operative Producers, c/o Union Construction Co., Ft. 14th St. Oakland, Calif., plans the construction of a canning plant and warehouse. Estimated cost $3,000,000.

Cement Plant—R. H. Hartley, Governor, Olympia, Wash., has under consideration a plan to establish a cement plant, 1000 bbl. capacity. Estimated cost to exceed $2,000,000.

Cement Plant—Lime Products Co., Home Insurance Bldg., Little Rock, Ark., will soon award the contract for the construction of a plant for the manufacture of portland cement at White Cliffs, Ark. Estimated cost $500,000. Lund Engineering Co., Home Insurance Bldg., Little Rock, Ark., is engineer.

Cement and Asbestos Slate Machinery—Spatato Societa Anonima Cemento Portland, via Riccardo Pitteri 8, Trieste, Italy, is in the market for cement and asbestos slate machinery.

Chemical Factory—Tailby-Nason & Co., 368 Congress St., Boston, Mass., is receiving bids for the construction of a 3 story, 50 x 90 ft. factory at Amherst and Carlton Sts., Cambridge. Estimated cost $50,000. F. E. Leland, 238 Main St., Cambridge, is engineer.

Chemistry and Laboratory—The Board of Trustees of Ohio State University, Columbus, Ohio, are having plans prepared for the construction of a 5 story, 84 x 150 ft. addition to the chemistry building here also 2 story 40 x 92 ft. laboratory at Gibralter. Estimated cost $300,000. Carl E. Steele is secretary. J. N. Bradford, Ohio State University, is architect. Special equipment to be purchased later.

Chlorine Control Apparatus—Wallace & Tiernan Co., 1 Mill Blvd., Newark, N. J., awarded contract for the construction of a 4 story factory addition for the manufacture of chlorine control apparatus, on Mills St., Belleville, N. J., (branch of Newark), to James Sutherland, 133 South 15th St., Newark. Estimated cost $150,000.

Clay Products Plant — Pan-Tex Clay Products Co., Casper, Wyo., c/o A. R. Lowey, Oliver-Eackle Bldg., Amarillo, Tex., is having plans prepared for the construction of a clay products plant at Amarillo, Tex. Estimated cost $75,000. Private plans.

Cocoa Plant—Reichardt Cocoa & Chocolate Co., 50 Broad St., New York, N. Y., is having plans prepared for the construction of a 5 story cocoa plant at Lincoln and Van Dyke Aves., New Brunswick, N. J. Estimated cost $500,000. Private plans.

Coke Ovens — The Columbia Steel Co., Provo, Utah, awarded contract for addition to by product plant to consist of 23 Becker type coke ovens and added by-product and benzol capacity to the Koppers Construction Co., Unioin Trust Bldg., Pittsburgh, Penn.

Condensed (Milk) Plant—The Borden Co., 510 South Dearborn St., Chicago, Ill., is having preliminary plans prepared for the construction of a condensed milk plant at Macon, Miss. Private plans. Work will probably be done by owner's forces.

Fertilizer and Cold Storage Plant—The New York Buyers' Association, Blue Starr St., San Antonio, Tex., c/o C. S. Guilham, has awarded the contract for a 1 and 2 story, 60 x 450 ft. plant, including ice plant, poultry feeding and fertilizer plant, to W. C. Thrailkill, Builders Exchange Bldg., San Antonio. Estimated cost $100,000.

Gas Plant—Jackson County Light, Heat & Power Co., Independence, Mo., plans to construct a gas plant. Private plans.

Gas Compressor Station—Empire Gas & Fuel Co., Bartlesville, Okla., had plans prepared for the construction of a gas compressor station at Woodward, Okla. Estimated cost $45,000. Private plans. Four 180 hp. compressor units will be required.

Gas Plant and Pipe Line—Lone Star Gas Co., 1915 Wood St., Dallas, Tex., is having plans prepared for the construction of a natural gas plant at Temple, Tex., Estimated cost $500,000. Private plans.

Gas Plant Addition—Illinois Power & Light Corp., Illinois-Merchants Bank Bldg., Chicago, Ill., plans to rebuild gas apparatus house, also 28 x 53 ft. gas house 45 ft. high. Estimated cost $50,000 and $85,000 respectively. Work will be done by owners' forces.

Gas Products Plant—Gas Products Co., S. D. Winger, V. Pres. and Gen. Mgr., Columbus, O., awarded contract for the construction of a gas products plant on Jennings Rd. to Van Blarcom Co., National City Bldg., Cleveland, O. Estimated cost $60,000.

Gasoline Plant—O. J. Berend, 2403 South Troost Ave., Tulsa, Okla., is having plans prepared for the construction of a casinghead gasoline plant, 7,000 gal. daily capacity at Somerset fields 20 mi. south of San Antonio, Tex. Estimated cost $500,000. Private plans. Machinery and equipment will probably be required.

Gasoline Plant—The Skelly Oil Co., Tulsa, Okla., will soon receive bids for the construction of a natural gasoline plant at Panhandle, Tex. Estimated cost $150,000. New machinery will be installed. Private plans.

Glass Plant—Gill-Glass Co., Amber and Tioga Sts., Philadelphia, Pa., awarded contract for the construction of a 2 story, 150 x 250 ft. glass plant to Gorman & Frank, 6912 Market St., Philadelphia, Pa. Estimated cost $200,000.

Glass Factory—The Ruth Glass Co., 10th and Hallowell Sts., Philadelphia, Pa., has awarded the contract for a 3-story, 60 x 60 ft. addition to the W. P. Cameron Engineering Co., Packard Bldg., Philadelphia.

Grape Juice Factory — Delano Grape Products Co., Delano, Calif., awarded contract for the construction of first unit to grape juice factory, 1 story, 200 x 200 ft. at Long Beach, Calif. to P. Magnuson, Delano, Calif. Estimated cost $80,000.

Graphite Plant, etc.—Southwestern Graphite Co., Burnet, Tex., has awarded the contract for a graphite and power plant on Llano River, to Southwestern Engineering Corp., Heyworth Bldg., Los Angeles, Calif. Estimated cost $300,000.

Gypsum Factory — Rumford Chemical Co., Rumford, R. I., will soon award contract for the construction of a 1 story gypsum factory. Estimated cost $40,000. Morton C. Tuttle Co., Park Square, Boston, Mass., are architects and engineers.

Hide and Skin Factory—Emil Kohn, Inc., 407 East 31st St., New York City, plans the construction of a 50 x 100 ft. factory on Fisk St., Jersey City, N. J. Estimated cost $40,000.

Ichthyol Development—C. Gonzales Zorilla, Tampico, Mexico, has leased the Ichthyol Mine in Bexar County, near San Antonio, Tex., and will develop same. New tools and machinery will be purchased.

Laboratory—The Radio Electric Clock Corp., 50 Church St., New York, N. Y., had plans prepared for the construction of a 1 story, 40 x 100 ft. factory and a 1 story, 60 x 100 ft. office building, including laboratory, at Linden, N. J. Estimated cost $55,000. W. Meyer, Jr. and R. E. Genez, 71 Bergenline Ave., West New York, N. J., are architects.

Laboratories—The University of Pennsylvania, 34th and Spruce Sts., Philadelphia, Penn., plans the construction of 3 story, 53 x 244 ft. and 25 x 144 ft. anatomical and physiological chemistry laboratories. Stewardson & Page, 315 South 15th St., Philadelphia, are architects.

Laboratories—The Board of Education, Toronto, Ont., plans the construction of a 2 story, 100 x 160 ft., high school on St. Andrew St., Fergus, Ont., to include chemistry and physics laboratories. Complete equipment will be required.

Laboratory Dynamometer — Constructing Quartermaster, Dayton, Ohio, awarded the contract for dynomometer laboratory building and utilities at Wright Field, here, to Charles H. Shook, Inc., Third National Bldg., Dayton. Estimated cost $175,000.

Laboratories (Metallurgy and Material Testing) — Purdue University, Lafayette, Ind., awarded the contract for the construction of a metallurgy laboratory to A. E. Kemmer, $13,000 also material testing laboratory to Charles L. Sanders, Portland, Ind., $17,525.

Laboratories (Pathological and Bacteriological)—Bd. of Trustees, Yale College and New Haven Hospital, New Haven, Conn., awarded contract for the construction of a 4 story, 178 x 242 ft. medical building including pathological and bacteriological laboratories, etc. at Cedar, Congress and Howard Sts. to Hegeman-Harris Co., 360 Madison Ave., New York, N. Y. Estimated cost $1,250,000.

Laboratories (Science) — Schoolhouse Dept., F. E. Slattery, Chn., Boston, Mass., will soon award contract for the construction of science laboratories at English School, Montgomery St. South End and Girls Latin School, Huntington Ave., Fenway Dist. Estimated cost $25,000.

Nitrogen Plant—The Allied Chemical & Dye Corp., 61 Bway., New York, N. Y., awarded contract for first unit of the proposed nitrogen plant to consist of steam generating plant at Hopewell, Va., to Stone & Webster, Inc., Boston, Mass., cost to exceed $5,000,000. Total $25,000,000.

Oil Factory—Cook & Swan Inc., South Front St., Elizabeth, N. J., awarded contract for excavation of a 3 story, 50 x 100 ft. oil factory to J. J. Thomas, 19 Mertz Ave. Hillside, N. J. Estimated cost $50,000.

Paint Mills—Dean & Barry Co., 296 North Water St., Columbus, Ohio, R. S. McKay, Pres., plans to purchase four paint mills to equip new addition to factory.

Paint Factory—The Farboil Paint Co., Eastern Ave. and 11th St., Baltimore, Md., will soon award contract for the construction of three 1 story factory buildings. Estimated cost $75,000. Sandlass & Wieman, 331 North Charles St., Baltimore, are architects.

Paint Factory—The Billings-Chapin Co., 1163 East 40th St., Cleveland, Ohio, paint manufacturers, has awarded contract for the construction of a 4 story, 60 x 120 ft. factory to George A. Rutherford Co., 2725 Prospect Pl., Cleveland. Estimated cost $150,000.

Paint Factory—George P. Darrow & Co., 5623 Germantown St., Philadelphia, Penn. paint manufacturers, has awarded the contract for a 2-story, 20 x 100-ft. addition to Samuel Harting & Son, 20 East Johnson St., Philadelphia.

Paper Mill—Advance Bag & Paper Co., Hodge, La., plans to construct a paper mill and bag plant by its own forces. Estimated cost $1,000,000. C. A. Ring is chief engineer.

Paper Mill—American Reinforced Paper Co., County St., Attleboro, Mass., plans construction of a paper manufacturing plant. Estimated cost $50,000. Architect not selected.

Paper Plant—The Grays Harbor Pulp Co., Aberdeen, Wash., has awarded the contract for the construction of the first unit of its plant here to Chris Kuppler & Sons, Seattle, Wash. Estimated cost $2,500,000 to $3,000,000.

Pottery Plant Addition—Coxon-Bellack China Co., Wooster, Ohio, plans 1-story, 20 x 47 ft. addition to plant including decorating kilns, etc. Estimated cost, $40,000.

Pulp Mill—The Northwest Pulp & Paper Co., J. Buffelen, pres., Tacoma, Wash., plans the construction of a 50 ton sulphide pulp mill to utilize waste products from logging operations. Estimated cost $500,000.

Pulp and Paper Mill—Canadian Pulp & Paper Co., 511 St. Catherine St. W., Montreal, Que., awarded contract for the construction of a pulp and paper mill at McGill University to E. G. M. Cape & Co. Ltd, New Birks Bldg., Montreal, Que. Estimated cost $250,000.

Pulp and Paper Mill—Hawley Pulp & Paper Co., Oregon City, Ore., awarded contract for the construction of a pulp and paper mill to A. Guthrie & Co., 1209 Builders Exchange Bldg., St. Paul, Minn. Estimated cost $600,000.

Pulverizing Plant — Golding Sons Co., Peace St., Trenton, N. J., awarded contract for the construction of first unit to feldspar grinding plant, at Putnam Ave. and East Trenton R.R., to C. J. Smith, 204 Academy St. Estimated cost $250,000.

Refinery (Oil)—Texarillo Refining Co., Amarillo, Tex., is having plans prepared for the construction of an oil refinery. Estimated cost $200,000. Private plans. Complete machinery and equipment will be required.

Rubber Factory—The General Tire & Rubber Co., 1708 East Market St., Akron, Ohio, had plans prepared for the construction of three factory buildings. Estimated cost $300,000. Osborn Engineering Co., 7016 Euclid Ave., Cleveland, is architect and engineer.

Rubber Factory—The Goodrich Rubber Co., Akron, Ohio, has awarded the contract for the construction of a factory, 250 x 1200 ft., main building 5 stories, at Mines Ave. in the Union Pacific industrial tract near Belvedere, Los Angeles, Calif., to the Foundation Co., 120 Liberty St., New York, N. Y. Estimated cost $5,000,000.

Rubber Factory—Paramount Rubber Co., 550 East 38th St., Paterson, N. J., is having plans prepared for the construction of a 2 story addition to rubber factory at Vreeland Ave. and Market St. Estimated cost $40,000. Private plans.

Silk Factory—Courbaulds, Ltd., Montreal, Que., Can., has awarded the contract for an addition to its factory at Cornwall, Ont., to the Foundation Co. of Canada, Ltd., 746 Sherbrooke St., W., Montreal. Estimated cost $300,000.

Silk Mill—American Bemberg Corp., 65 Madison Ave., New York, N. Y., is having plans prepared for the construction of a silk mill at Elizabethton, Tenn., to double the capacity. Lockwood-Greene Inc., 100 East 42nd St., New York, N. Y., are architects and engineers.

Steel Plant—The Gulf States Steel Co., B-M. Bldg., Birmingham, Ala., plans extensions and improvements to plant including ore and blast furnaces, coke ovens, finishing mills, etc. Estimated cost $3,000,000. Machinery and equipment will be required.

Sugar Mill—Compania Tabacalera, Barcelona, Spain, awarded contract for the construction of a sugar mill, 5000 metric ton daily capacity at Tarlac Province, P. I. to Fulton Iron Works, 1259 Delaware St., St. Louis, Mo. Estimated cost $2,000,000.

Sulphur Plant—Texas Gulf Sulphur Co., c/o Walter H. Aldridge, President, 41 East 42nd St., New York, N. Y., plans the construction of a sulphur plant at Gulf, (Mail Big Sandy, Upshur Co.), Tex. Estimated cost $100,000. Complete equipment will be required.

Sulphuric Acid Plant—Consolidated Mining & Smelting Co. of Canada, Ltd., Trail, B. C., is having plans prepared for the construction of a contact process sulphuric acid plant at Tadanac, B. C. Estimated cost $250,000. Work will be done by owners or sub-contractors.

Tile Factory—Depoli Mosaic Tile Co., 935 Massachusetts Ave., Boston, Mass., is receiving bids for the construction of a 1 story, 50 x 145 ft. tile factory at Roxbury, Mass. Estimated cost $40,000. D. M. Foster, 875 Massachusetts Ave., Boston, Mass., is architect.

Waste Starch Plant—A. E. Staley Mfg. Co., Decatur, Ill., plans the construction of a 3 story factory for handling waste in starch and converting into salable by-products. Estimated cost $100,000. Private plans.